THE IRON TRADE REVIEW

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VOLUME XXXIII. CLEVELAND, O. MAY 3, 1900. CHICAGO, ILL. NUMBER 18

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MAY 3, 1900. CHICAGO, ILL. NUMBER 18

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The effects of the recent disturbances in the iron trade are seen in the almost complete cessation of buying in some lines, and it is evident that the situation must be allowed to work out into clearer atmosphere before confidence comes again. The fact that prices are not consistently or normally graded, from raw materials down through the various finished materials makes the condition in a measure artificial, and while this is the case free buying is out of the question. Finished materials are yielding, where they are not controlled either by agreement or by well-nigh exclusive production, and buyers cannot be expected to commit themselves for more than their immediate needs. The belief is quite general that the time has come for lower prices in such materials, whether raw, intermediate or finished, as have not already come under readjustment, but there are a good many obstacles to the practical realization of such a condition. The cut in wire products brought them to a point at which there could be no profit were they produced entirely from steel bought in the market at $35, mill. This is the ground for the prediction already made that wire and wire nails will soon be advanced. Whether the large steel producers will come part of the way is not indicated as yet. The nominal quotation is still $35, though Pittsburg reports transactions at $31 to $31.50. The tonnage is very small, however, and there is practically no market price and will be none until established by transactions with the tin plate, sheet, hoop or wire interests. The merchant furnaces in the valleys producing Bessemer iron have decided to maintain the $24 valley furnace basis on all deliveries up to July 1, and the requisitions for iron for the second half from the large steel companies are such as to guarantee a firm market for the balance of the year, but no new contracts have been closed for third and fourth quarters. That the future of the foundry pig iron market will be decided by the export demand is made more evident this week by the receipt of an inquiry for 100,000 tons by the leading Southern interest. The deliveries asked extend into next year. The one drawback in connection with this business is the difficulty of getting ocean tonnage when wanted, and at reasonable rates, the South African war having advanced freights considerably. Southern irons in Northern markets are quite firmly held, and concessions from recent quotations appear not to have gone beyond 50 cents. Northern foundry irons are generally weaker, but so little business is done that this is not significant. The demand of Central Western molders for a $3 minimum is still pending and a decided element of uncertainty. A strike has been prevented thus far and the present week will show whether the crisis will pass without an open rupture. The indications as they are found in finished material are encouraging. The aggregate of week-to-week orders is good, and the situation suffers by comparison with last year only because the free contracting so noticeabe then is absent. Consumption in many lines is greater; conclusions to the contrary result from the enlargement of capacity that has come in the year. Few changes of prices are to be noted for the week. Plates are from $1 to $2 a ton lower, and bars have been shaded below the price established by the recent $5 reduction. Independent mills are making the concessions. When they have been filled up, firmer conditions may be expected. The cut nail manufacturers reduced the basis 45 cents or to $2.10 a keg, Pittsburg, in carload lots.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
828 PARK BUILDING, May 2.

Owing to the numerous rumors set afloat during the past 10 days to the effect that prevailing quotations on Bessemer pig iron are being shaded, a meeting of the association was held in Cleveland Saturday, at which it was decided to maintain the price of $24, Valley, and $24.90, Pittsburg, until July 1. The non-association furnacemen are also understood to be in the agreement. No action was taken on the inquiries for iron for delivery the second half, despite reports to the contrary. When the meeting will be held for the purpose of fixing a quotation on these inquiries is not known at the present time. There has been nothing doing in Bessemer during the past week and all other kinds of pig iron are equally quiet. The buying movement of the foundrymen has as yet failed to materialize, despite their almost depleted stocks. Plates continue weak, although there have been more inquiries than for some time, and numerous sales are reported in small lots ranging from 50 to 100 tons. On desirable orders mills are quoting 1.75c, yet 1.70c might be done on very large orders. The closing down of four merchant bar mills by one of the large producers in this district on Monday gave rise to all kinds of rumors about a falling off in orders. The concern pursues a very conservative policy and rather than accumulate a lot of stock shut down the mills that on Monday lacked orders; but three of the four were again started Tuesday, enough orders having been received to insure their operation for some time. The largest reduction on finished products is that made by the association of cut-nail manufacturers—45 cents per 100 pounds, to meet the cut made on wire nails by the American Steel & Wire Co. Jobbers in this city have as yet failed to receive advance quotations on black or galvanized sheets from the American Sheet Steel Co., and the latter continues to quote prices for delivery within 60 days and on specifications only.

PIG IRON.—The past week has been one of unusual quietness in the pig-iron trade. No sales of Bessemer are reported by the association, and independent furnaces, which agreed to uphold the price of $24, valley, quoted by the association until July 1, have made few, if any, sales. Foundry iron is inclined to be weak, and No. 2 is held at $22 although it is reported that this price is being shaded by furnaces anxious to close business. Forge iron is also a trifle weaker, and is generally held at $20, which figure it is said might also be shaded. There is little Southern iron to be had. One sale of several car lots of No 1 Southern soft was made at $23 35, delivered, but this does not represent the market. The foundrymen in this district continue to hold off in hopes of still lower prices. It is a well-known fact that their stocks are running very low and that they are buying only from day to day. We make the following quotations:

Bessemer, valley furnace	$24.00
Bessemer, Pittsburg	24.90
No. 1 Foundry	$22.50 to 23.00
No. 2 Foundry	21.75 to 22.00
No. 3 Foundry	21.00 to 21.50
Gray Forge, valley furnace	20.00 to 20.25
Gray Forge, Pittsburg	20.00 to 20.25

STEEL.—Despite the fact that some of the larger steel producers are holding 4x4 steel billets at $35 nominally at mill, Pittsburg, Wheeling or Valley, sales in small lots are being made at prices ranging from $31 to $32. On very desirable orders it is believed that $31 can be shaded, although there are no inquiries to indicate any large contracts being placed. For small billets and special sizes an advance of $1 per ton over these quotations would be asked. Sheet bars continue very quiet and no sales have been reported on which to base a current quotation. In view of the falling off in the price of billets, however, it is certain that much better than $36 can be

done. Basic open-hearth billets are held at $33.50 to $35, with little demand.

FERRO-MANGANESE.—We continue the quotation of $125 for 80 per cent, Pittsburg.

RAILS AND TRACK MATERIAL.—There has been little doing in rails for domestic delivery during the past week, mills working on orders placed several months back. Foreign inquiry continues week by week. Track material remains in fair demand, with prices unchanged. Our quotations follow: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37; all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts, square nuts, 3.60c; hexagon nuts, 3.60c to 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 3.10c.

SPELTER.—The weakness in the price of spelter which set in the early part of last week continued until prime Western grades can be had at 4 60c, Pittsburg. The market is easy.

SKELP.—There is little inquiry for skelp, and the sales during the past few days have been limited to small lots only. Grooved iron and steel skelp is held at 1.95c while sheared iron and steel is quoted at 2.05c to 2.10c.

MUCK BARS.—This product is exceedingly quiet and the demand at the minimum. What sales have been made were for small lots only, for immediate delivery. The market is easy at $31 to $31.50.

BARS.—It has been reported during the past few days that the revised quotation of 2c on steel bars is being shaded. If so this is being done very quietly. Some of the smaller outside mills may be shading 2c, Pittsburg, on steel bars, but the large producers seem not to have lost orders from the competition. The demand has not increased despite the recent reduction. We quote 2c, Pittsburg, for large lots and 2.10c for small lots. Common iron bars are held at 1.90c, valley, and refined iron bars are quoted at 2.10c and 2.15c.

STRUCTURAL MATERIAL.—The largest order placed for structural material in the past week was for a Pittsburg building to consist of about 600 tons. The business was taken by the Carnegie Steel Co. All the structural mills continue to be operated full with orders that will employ them for weeks ahead, and the demand is good, with no indications that prices will be changed. We continue the following quotations: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, from 3 to 6 inches, 2.25c. Universal mill plates, 2.10c to 2.20c, according to delivery and size of order.

PIPES AND TUBES.—Owing to the scare given jobbers by the sudden cut in prices by the American Steel & Wire Co., a number carrying wrought pipe sold off their stock on hand, shading the prevailing quotations. The slump they expected on this material failed to materialize, however, and with orders coming in at the present rate it is said there is no prospect of a cut from present quotations being made. The export demand for pipe is good, and the largest producer reports several desirable orders during the past week. Discounts by the jobbers at all centers north of the Ohio river and Virginia line east of St. Louis, Chicago and Milwaukee, to the Atlantic coast follow: Merchant pipe, car lots, ⅜ to ¾-inch, black 25 and 10, galvanized, 17; less than car lots, black, 25 and ½, galvanized, 10; ½-inch, car lots, black, 25 and three 10s, galvanized, 20, 10 and 2½; less than car lots, black, 25, two 10s and 2½, galvanized 20 and 5; ¾-inch, car lots, black, 25, four 10s and 5, galvanized, 20, two 10s and 2½; less than car lots, black, 25, three 10s and 7½, galvanized 20, 10 and 5; 1 to 4 inches, car lots, 25, four 10s and 7½, galvanized, 20, two 10s and 5; less than car lots, black, 25 and four 10s, galvanized, 20, 10 and 7½; 4½ to 12 inches, car lots, black, 25 and four 10s, galvanized, 20 and two 10s; less than car lots, 25, three 10s and 2½, galvanized, 20, 10 and 2½.

PLATES.—The effort to bring about an agreement on plates has failed to bear fruit and the market continues to suffer. Tank plates are weaker, and on very desirable orders some of the large mills will quote 1.70c. For assorted widths, 1.75c is asked, and forms all lots the prevailing quotation is 1.80c. The low quotations have stimulated the demand somewhat and a number of orders for lots ranging from 50 to 200 tons were placed during the past few days. Shell steel is held at 2.05c to 2.10c, with flange steel at 2.10c to 2.15c. Fire box is not affected by the low price on tank plates and the quotations range from 2.75c to 3 25c.

SHEETS.—Jobbers and consumers have as yet received no schedule quotations from the American Sheet Steel Co. On black and galvanized sheets, the company is confining its quotations in answer to inquiries, to delivery within 60 days. Quotations received by local jobbers indicate a market price of 3.20c for No. 27 gauge and 3.30c for No. 28 gauge. On galvanized, discounts of 70 and 10 are quoted with the usual 15-cent freight allowance.

OLD MATERIAL.—Scrap has gone off somewhat during the pats 10 days. Despite this fact there is little buying and dealers are making many concessions in the few small sales that are being made. Our quotations follow: New Bessemer melting stock $23 to $24; old steel rails, mixed lengths, $22.50 to $23; short lengths, $23.50 to $24; old iron rails, $23 to $24; cast borings, $12 to $13, gross tons; cast scrap, $16 to $17; No. 1 wrought scrap, $21 to $22, net tons; busheling scrap, $15 to $16, net tons; old car wheels, $23 to $24.

COKE.—Coke for immediate delivery, both foundry and furnace, is very scarce and in many instances prices higher than the prevailing market quotations are paid. Stocks are by no means accumulating in the Connellsville district, and with the present great demand, furnaces and foundries being operated at their fullest capacity, there is no probability of an accumulation of stocks. Furnace coke is held at $3 50 to $4 and foundry coke at $4 to $4.25.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, May 1.

The entire market has been very quiet all the week. The demand seems to be limited to comparatively small lots, but these are frequent, as a good many buyers have about used their supply of material and are now buying from hand to mouth, in the hope that lower prices will be made soon, or before it actually becomes necessary for them to make extensive purchases. There is little doubt that the recent developments in the wire and nail departments of the market have strengthened the belief on the part of buyers that prices will be lower if they can only hold off long enough, but sellers of all kinds of material adhere to their frequently expressed opinion that quotations will be little if any lower than at present.

PIG IRON.—No very large sales were made last week, the buying being limited to small lots, with the exception that considerable purchases of charcoal iron have been made by the car wheel interests. These purchases have covered the past ten days or two weeks, and have aggregated, probably, over 30,000 tons, all told. About half of this amount is for delivery to the works of the American Car & Foundry Co., the balance being divided between two or three other buyers. The general demand is not large, and does not include many very important orders. It is not expected the general buying will be much greater than at present until the labor troubles have been entirely satisfied, but it is hoped this will occur within a short time. Buying has been small for so long a time that there is undoubtedly a large tonnage to be placed as soon as the foundries are sure there is to be no more labor difficulty, and that prices have definitely reached bottom. Quotations have not changed within the week, and are now as follows:

Lake Sup. Charcoal	$24 50 @ $25 50	Southern Coke No. 3	$20 85
Local Coke Fdy. No. 1	23 00 @ 24 00	Southern No. 1 Soft	21 35 @ $22 85
Local Coke Fdy. No. 2	22 50 @ 23 00	Southern No. 2 Soft	21 35 @ 21 85
Local Coke Fdy. No. 3	21 50 @ 22 00	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	23 00 @ 24 00	Jackson Co. Silveries	31 50 @ 32 50
Local Scotch Fdy. No. 2	22 50 @ 23 00	Ohio Strong Softeners	24 00 @ 25 00
Local Scotch Fdy. No. 3	21 50 @ 22 00	Alabama Car Wheel	25 00 @ 26 00
Southern Coke No. 1	22 35 @ 22 85	Malleable Bessemer	24 00 @ 25 00
Southern Coke No. 2	21 35 @ 21 85	Coke Bessemer	24 00 @ 25 00

BARS.—Sales have not been especially large, although one or two good contracts were placed in the week. It is asserted that mills outside of the combination are again quoting prices much below the schedule, and that sales have been made as low as 1.85c, Chicago, for iron. Schedule prices are unchanged at 2 05c for iron, and 2.10c for steel bars, half extras, Chicago delivery.

CARS.—Two or three fairly good orders for cars were placed last week, and there are others being figured on at present which will be placed within a short time. There is a good demand for material, and quite a little business was done last week.

BILLETS AND RODS.—There is no change in the market, and sales have been only for small lots. Nominal quotations are $35 for Bessemer billets; $39 for open-hearth billets; $37

for sheet bars; $65 for open-hearth rods, and $55 for Bessemer rods.

PLATES.—Business has been confined to small lots, with the exception of one order for 1,000 tons, which was placed early in the week. We quote tank steel from store 2.50c to 2.60c. Mill shipments Chicago delivery: Tank steel 2.05c to 2.15c; shell, 2.15c to 2.25c; flange 2.20c to 2.30c; marine, 2.25c to 2.35c; fire box, 2.75c and up, according to brand.

RAILS AND TRACK SUPPLIES.—Orders for standard sections last week aggregated about 1,000 tons, and light sections sold in about the same amount. No important contracts were closed or are in negotiation. Quotations follow: Rails, standard sections, $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.65c to 2 75c; track bolts, 3 85c to 3.95c.

STRUCTURAL MATERIAL.—Little business was placed, and almost all of it was for delivery outside of the city. The labor situation is unchanged, and there is no relief in sight. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.10c to 2.20c; universal plates, 2.10c to 2.20c; tees, 2.45c; zees, 2.40c; small lots from store are quoted ¼c to ½c higher.

SHEETS.—No mill business has been done in the week, as the sheet steel company is still not in shape to handle it from this office. Store business is on a basis of 3 55c for No. 27 black, and galvanized is selling at 70 and 5 per cent off for mill shipments.

MERCHANT STEEL.—No large orders have been closed, the business being confined to small lots for store shipment. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3 75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Considerable business has been placed in small lots, but there were no large orders in the week, nor are there any in sight for the immediate future. The following are Chicago prices for store shipment:

Sizes.	Black.	Galvanized.
⅛ to ¾-inch	25 and 2½	10
¼-inch	25, 10, 10, 2½	20 and 5
¾-inch	25, three 10s, 7½	20, 10 and 5
1 to 4 inches	25 and four 10s	20, 10, 7½
4½ to 12 inches	25, three 10s, 2½	20, 10, 2½
1 to 4 inches, R. & P.	25, three 10s and 5	20, 10 and 2½

Pipe cut to lengths special prices upon application. Car loads at 5 per cent additional discount from above prices.

WIRE AND WIRE NAILS.—The reduction in prices has brought a largely increased demand for both wire and wire nails and sales last week were much in excess of those of any previous week for some time past. The opinion was expressed by an official of the American Steel & Wire Co., that if the present demand and sales continue for two weeks longer surplus stocks will be reduced to a point at which it will be necessary to start the mills up again in full. Country buyers have been especially active and have made large purchases in the past week. There have been no changes in quotations. Makers quote single car loads of wire nails at $2.53 f. o. b. Chicago, and $2.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $2.48; painted barb wire, $2.98; galvanized barb wire, $3.13.

OLD MATERIAL.—The demand is limited to small lots, and no large sales and only a few small ones were made last week. The market is weak, and lower prices are named on almost every product. Offerings of scrap are small, and there seems to be very little supply of some grades. Car wheels are very firm, and bring the highest prices of any grade of old material in the list. Dealers' selling prices per gross ton are now about as follows:

Old iron rails	$22 00@$21 00	Country malleable	$13 00@$14 00
Old steel rails, long	20 00@ 21 00	Iron axles	25 00@ 26 00
Old steel rails, mixed	17 00@ 18 00	Cast borings	7 75@ 8 25
Relaying rails	28 00@ 30 00	Wrought turnings	11 50@ 12 00
Old wheels	24 00@ 24 50	Iron axle turnings	13 50@ 14 00
Railroad forge	21 50@ 22 00	Steel axle turnings	11 50@ 12 00
Dealer's forge	15 00@ 15 50	Mixed country steel	12 50@ 13 00
No. 1 cut mill	13 50@ 14 00	Stove plates	8 75@ 9 25
Heavy cast	13 00@ 13 50	Heavy melting steel	16 00@ 17 00
Railway malleable	17 00@ 18 00	Old iron splice bar	22 50@ 23 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., May 2.

The ore freight situation continues quiet. Shippers do not appear to need wild tonnage, and in Escanaba cargoes the daily rate has been below the contract rate thus far, 90 cents being done last week and on Tuesday a single small boat being placed at 80 cents. From the head of the lake there is little offering. Dock operations at Lake Erie ports are active, and the statistics of stocks remaining on dock May 1, when officially tabulated, are expected to show a relatively well cleaned-up condition. There is not the apprehension this spring that was generally expressed one year ago, as to the ability of the mining companies to meet the demand upon them. Stockpiles in the Lake Superior district have been growing at an unusual winter pace since Dec. 1, and mining forces have increased in numbers and efficiency in the past year. If calculations as to the ore movement from Lake Superior and Lake Michigan are realized there must be a heavy sale of ore in the next six months.

PIG IRON.—The market is very dull. In Cleveland the machinists' strike has affected operations in a few foundries and in two or three instances shipments of iron have been held up. The rule is, however, that iron is being taken forward up to full contract arrangements, and it is known that foundry yard stocks in general have been reduced in the past four months. Some irregularity in prices is noticed, but concessions do not lead to larger orders. For No. 2 foundry iron the small-lot quotation is $22, valley furnace, but the equivalent of $21.50 is possible on certain brands. There has been no improvement in working schedules of valley mills and meantime forge iron is very dull. Southern can be had delivered in the valley at $19.50. Northern is nominally $20 to $20.50, valley furnace. In Bessemer iron the development of the week is the announcement following a meeting of the Bessemer furnacemen's association on Saturday, that the price of $24, valley furnace, will be maintained on deliveries up to July 1. It is intimated also that in view of the fact that half the 600,000 tons likely to be produced in the second half is already spoken for by one interest, and there is no indication that the supply from merchant furnaces will be in excess of the demand by steel works, the market will be strong throughout the year. We quote Cleveland deliveries:

Bessemer	$24 90	Valley Scotch No. 1	$23 00
No. 1 Strong Foundry	22 75@ 23 00	Valley Scotch No. 2	22 50
No. 2 Strong Foundry	22 25@ 22 50	Gray Forge, valley	20 00@20 50
No. 3 Foundry	21 50@ 21 75	Lake Superior Charcoal	24 00@25 00

FINISHED MATERIAL.—The waiting attitude of many buyers continues. While a good tonnage comes into local selling offices week by week, it is made up of littles, and the action of buyers is in such contrast with the free contracting in progress one year ago that the impression is out that consumption is contracted. The only indications of this sort are in the case of interrupted operations due to strikes and in the abandonment or curtailment of building plans. Announcement is made that the Bradley estate which puts a certain amount of money into new buildings every year, will not build this year because of the high price of steel. Structural mills are better supplied with tonnage, however, than any others, and with the active season just ahead, there seems no likelihood that the 2.25c Pittsburg basis for beams and channels will be changed for some months. Angles are firm at the same price for 3-inch to 6 inch sizes. Reports from the Mahoning valley indicate that the bar mills now running are operated about three days out of the week while portions of the plants are shut down altogether. The present condition is quite in contrast with the full operation in all departments one year ago. We quote 1.90c, valley mill for bar iron, with freight added to point of destination. On orders from store 2.20c, Cleveland, is the market. There is little buying, and independent mills have gone enough below the quotations of the leading producer to take a considerable part of the going business. Buying is expected to be in small lots for some time. Steel bars are generally held at 2c, Pittsburg, though there are rumors of cutting. The plate market, considering its weakness, is fairly active, business in moderate lots coming up from many quarters. We quote 1.80c, Pittsburg, for tank on small orders for assorted widths and gauges, while as low as 1.70c has been bid for the larger and more desirable business. The sheet market is quiet, and 3 20c for No. 27 and 3 30c for No. 28, Cleveland delivery, are the prices quoted from mill.

WIRE AND WIRE NAILS.—There is more activity as buyers are beginning to appreciate the depth of the cut made 10 days ago. It is not unlikely that an advance will come within the month. 2.20c, Pittsburg, for nails to jobbers being quite out of line with raw and intermediate materials. We quote the schedule of Pittsburg prices on carload lots to the retai

trade: Wire nails, $2.35; plain annealed wire, $2.30 base; painted barb wire, $2.80; galvanized, $2.95.

OLD MATERIAL.—The market is lower, and where business is done it is at considerable concessions from quotations lately made. Old iron rails, which until early in the year were scarcely obtainable, share in the general weakness and are now quoted $20 to $21, gross ton, with practically no demand. We quote old steel rails $19 to $20, gross ton; old car wheels, $22, gross ton; No. 1 wrought scrap, $18, net ton; mill scrap, $12 50 to $13, net ton; No. 1 machine cast scrap, $15, net ton; wrought turnings, $11 to $12, net ton; cast borings, $9.50 to $10 50, net ton; stove plate, $9.50, net ton.

CINCINNATI.

May 1.

There is continued inquiry for pig iron for export. For home consumption the trading in pig iron is light, and almost entirely in small lots. Prices on Southern iron are firmer than those for Northern. Rogers, Brown & Co. say: "One need not be an optimist to feel that the future gives promise of safety and continued prosperity, and this feeling seems to pervade the trade so that the startling sensations referred to [American Steel & Wire Co.] is fast losing its force, and the trade is beginning to realize that there was no occasion for the disturbance that have been brought about by about the most remarkable episode the iron and steel industries of the country has ever experienced. The business of the week has naturally been much less than it would have been owing to the remarkable agitation referred to, but there are already signs of a reaction, and there is every reason to believe that a fortnight will find the equilibrium established, confidence restored, and the trade proceeding upon its normal plane in a healthy condition. Prices have been unsettled, but are recovering, and it is reasonable to believe that the market very soon will be noted for its improved strength, and the orders that have been in suspension, will be booked and general business go forward on a substantial basis."

We quote the following from Matthew Addy & Co.'s market reveiw: "The surest evidence of the actual and statistical strength of the pig iron market that could be furnished has been found in the developments of the past 10 days. The market has been hammered unmercifully and the finished steel products have had a horizontal reduction in price that was so great as only to be described by the word sensational. Every influence that could be brought to bear has been exerted on the bear side of the market, yet in spite of everything pig iron has manfully held its own and today Southern pig iron prices are not materially different from what they were before the American Steel & Wire Co. disturbance. If there had been anything radically wrong with the pig iron market, if there had been any serious soft spots in it, there is no question that prices would have dropped. As a matter of fact there is very little iron to sell. There are some grades of some iron which are absolutely unobtainable for quick shipment and Southern iron masters are so far sold ahead that they can without the least anxiety bide their time.

"During the past week there has been a very good tonnage of small orders for Southern iron, while Northern iron has really been in quite active demand. The buying has been of the hand to mouth variety, for it is quite evident until the general market becomes stable that pig iron buyers will naturally try to supply only their immediate wants. Consumers have very little iron in their yards and we know of many concerns that are dependent upon the daily receipt of iron to keep running. The export demand is still keeping up in a marvelous way. Monday the Tennessee company received an inquiry for 100,000 tons of iron, scattered grades, shipment through the latter half of this year and through the first three or four months of 1901. As far as Southern iron is concerned the export trade apparently is only limited by the available ocean freightage."

PHILADELPHIA.

May 1.

While nothing in actual market transactions the past week would indicate improvement, the sentiment is undoubtedly less pessimistic than at this time last week. Southern furnace companies have given the representatives more confidence by reason of the good-sized export orders taken, and there are those who predict that the export business will go on until the situation as to pig iron in the second half of the year will be firm compared with the condition now existing. So far as stocks and production go there is nothing in the pig iron situation to justify the belief that prices are to fall away materially, yet the market just now is exceedingly dull and there is no sign on the part of buyers to take hold. Producers are willing to make slight concessions to hold their trade, and the fact that almost nobody in the foundry trade is willing to buy more than 50 to 100 tons makes the concession easy, as it is of no great significance either way. This policy does not help buyers to see that a higher market is likely in the next few months. We quote No. 2X foundry at $21.50 to $22 delivered at seaboard or nearby points; No. 2 plain at $20.50 to $21; mill iron $18.50 to $19. There is more figuring on foreign business of late, and something has been done in bars and skelp. Foreign rail business has been something of a factor in the past month. The market for finished material is unchanged as to volume in the past week. Buyers are only providing for immediate needs, and mills have great difficulty in keeping full running schedules. Prices are at the lowest point of the year and there is active competition for everything that comes up. Everybody is doing what would be considered a very good business under ordinary circumstances, but it suffers in comparison with the insistent demand of last year. There is no question that the foreign trade will help matters, if it should increase in the way that now seems likely. Bars, pipe, rails and structural material can be marketed abroad in considerable quantities and quite profitably to the mills. There is no immediate prospect, however, of better prices locally. In bar iron there is sharp competition between Eastern and Central Western mills, but buyers are not placing contracts, preferring to supply immediate wants and wait for the market to settle. Eastern bar iron producers have held another meeting in the week. The policy is to meet competition and at the same time preserve a measure of agreement. We quote best refined bar iron at 1.80c to 1.90c; tank plates, 1.90c to 2c; beams and channels up to 15 inches, 2.40c; angles, 2.40c; No. 27 sheets, 3.20c; No. 28 sheets, 3 30c.

BIRMINGHAM.

April 30.

The local iron market continues steady but few offers to buy at prevailing prices are received by the furnacemen. In the past week several orders at reduced prices have been received but the iron masters would not consider them, believing that the conditions did not warrant a scaling of prices. The president of one of the furnace companies states that his company had received several orders within the past week or 10 days, but that no sales to amount to anything had been made. The local production is sold out well into the summer and some of the companies have orders on their books that will take their entire output until October. The sale of 25,000 tons for export made by the Tennessee Coal, Iron & Railroad Co., the early part of last week, at prices nearly equal to those on domestic iron, calls for 10,000 tons of gray forge, 10,000 tons of No. 2 foundry, and 5,000 tons of a lower grade. Delivery is to be made the latter part of the year.

The statement made by President Gates, of the American Steel & Wire Co., recently that the demand for the products of his company was not equal to the output, does not represent local experience. Furnacemen here have large contracts unfilled and no large stocks of pig iron. The statistics and the present consumption of pig iron, coupled with the crippled condition of local furnaces on account of the recent floods give ample reason for the confidence of Southern sellers.

Local prices of iron are not quite so stiff as in the recent past, but in general the following basis is maintained:

No. 1 Foundry	$18.25 to $18.50	No. 3 Foundry	$16.00 to $16.25
No. 2 Foundry	17.25 to 17.50	Gray Forge	15.00 to $15.50

The roof of the main foundry building of the Dimmick Pipe Co.'s plant at North Birmingham collapsed April 28, and two men were killed and 12 seriously injured. The accident will cause a delay of about a month in getting the works started. The building was about completed and the officials expected to be making pipe by the first of June.

The Republic Iron & Steel Co. will build 400 coke ovens at Thomas, Ala., three miles from Birmingham, to supply its blast furnaces at that place. An order for 2,000,000 fire brick has been let to the Bessemer Fire Brick Co.

An effort is being made by the citizens of Anniston, Ala., to build a blast furnace at that place, the capital stock to be subscribed locally. It is proposed to capitalize the company at $125,000. The two furnaces of the Woodstock Iron Co. at that place have been idle for 10 years and the owners will not consider any propositions for putting them in blast.

The Columbus Iron Works Co. of Columbus, Ga., will build a branch plant at Ensley, six miles from Birmingham. The site has been selected and machinery ordered. Work on the erection of the building will be begun at once.

COLUMBUS IRON & STEEL CO.

The decision to establish a blast furnace plant at Columbus, O., utilizing portions of the Hocking Valley furnaces and equipment purchased last year by Col. H. A. Marting, F. H. Miller and their associates, was reached after careful consideration of the advantages of several sites, in the assembling of raw materials and the distribution of finished product. Col. Marting, who is at the head of the Marting Iron & Steel Co., of Ironton, O., has been made president of the new furnace company, known as the Columbus Iron & Steel Co., and Mr. Miller, well known through his connection with the Miller, Wagoner & FieserCo., is vice-president and general manager. In selecting equipment for the new plant which is rapidly being put in shape, they have chosen that which has been thoroughly tested in a practical way, avoiding complicated arrangements, under the belief that some of the latter often require as much expense in mechanical operations and in the labor of machinists to keep them in order, as could be saved in the furnace labor which they make it possible to dispense with. The engineering features of the plant have been in charge of Walter Kennedy, of Pittsburg, and so expeditiously has the work been brought along that it is expected the company will be making pig iron within about six months of the beginning of construction. At the site selected the ground is almost level and is of such character that it is necessary to go only below the frost line to get a good foundation. In addition to this advantage a good water supply can be obatined by drilling wells to a depth of about 40 feet below the surface.

The two furnaces are exact duplicates, except for being right and left, and are 17 feet by 75 feet. Each hearth and bosh will be fitted up in a manner comparing favorably with any of the larger modern furnaces, being provided in addition to the eight tuyere coolers with numerous bronze plates so arranged that any of them may be easily and quickly removed. Everything pertaining to the lower part of the furnace has been made heavy enough to insure strength without approaching clumsiness. The most interesting feature perhaps is the filling arrangement, which is covered by patents belonging to Walter Kennedy, and has been in successful operation for several years. As with the top equipment of the large furnaces built in the past few years, it removes the annoyance caused by strikes of the top fillers, and prevents the danger of loss of life in case of an explosion which might wreck the top of the furnace. It also effects a great saving in the fuel which is ordinarily wasted at the top of the furnace when the big bell is open, as it forms a perfectly working gas seal. The bell, hopper, and the parts of the furnace above the charging platform are not subjected to the heating and cooling and incidental expansion and contraction which ordinarily occur when the bell is open, allowing the gases to flame out. Good distribution of stock is secured and cannot be affected by dissatisfied workmen.

The hopper is of the usual design, but resting on this is the gas seal hood, the top of which forms a seat for the distributing arrangement known as the "clam shell" or "chestnut burr." This consists of a small hopper-like ring, with a cylindrical opening and lugs to which are hinged the clam shell. The latter consists of four wings which when closed form a cone with the apex down and fitting around the bell rod so as to prevent the escape of gas when the large bell is lowered. The clam shell is operated by a beam similar to that for the large bell, to which each wing of the former is attached by means of a chain. Both the large bell and the clam shell are worked by means of cylinders actuated by either steam or compressed air, which are controlled by the same man who operates the skips, charges the coke, and superintends the charging of the other materials. This man stands at a convenient point near the bottom of the incline traveled by the skips and from this point he controls all the filling arrangement of the furnace. No handling of coke is necessary, this being emptied directly from the cars into bins and then into the skips by gravity.

The skip ropes are carried over the top of the framing, down on the back or opposite side to the incline and across on each side of the hopper to a sheave under the incline and from this down to the engine, which stands under the incline on a solid foundation. This arrangement permits of several desirable features, viz.: building the engine on a solid foundation instead of up on a high trestle; giving the skips a variable travel instead of bringing them up against a fixed guide, dumping lever or stop; and simplifies the top framing by making the pull of the ropes in line with the girders of the incline, thus transmitting the strain directly to the foundation.

A useful adjunct to the top of these furnaces is a small jib crane on each so arranged that the bell may be placed on top of the furnace and any part of the top which requires removing may be swung into place with very little trouble, and the various details of the top are so made that they may be very easily removed for the purpose of changing a bell or any other portion. The loss of time which usually attends keeping the bell and hopper in good working condition is much diminished in this case, from the fact that there are no top fillers to be annoyed by gas leaks; a change may be made from an old bell to a new one because the filling arrangement does not need to be interfered with until the bell is on top of the furnace; and the bell itself lasts longer because it is not alternately heated and cooled by the escaping gases.

The various accessories to the plant will be similar to general practice. There will be six 18x75 foot Foote stoves, three for each furnace, and the plans are so made as to permit of the addition of a fourth one to each furnace if it is ever considered necessary. The blowing capacity will be very liberal for furnaces of this size, there being five engines with 54-inch by 84-inch air cylinders, so arranged that any one of them may be disconnected from the receiver and still have two engines on each furnace, and also when one furnace is out of blast any or all of the engines may be put on the other furnace.

The boiler plant will consist of six vertical water-tube boilers of 350 nominal h. p. each, and here also provision has been made for additional boiler capacity when necessary. Each boiler will be fitted with an independent stack, but the six stoves will lead through underground flues into a common stack which will be 8 feet diameter and 175 feet high.

A common gas flue will pass between stoves and boilers and will be so arranged that the gases from both furnaces may be combined when both are in blast, or one furnace may be shut off entirely and yet any or all of the boilers can be in use. Each furnace will have a cast house 60 feet wide and 175 feet long. There will also be a common stock house 62 feet wide and 300 feet long which, as well as the cast houses, will be built of steel.

The pumping plant will have a circulating system with a capacity of from 5,000,000 to 6,000,000 gallons and a fresh water supply of 2,000,000 gallons. The fresh water is pumped from deep wells directly into the stand pipe which will be 18 feet diameter and 60 feet high. The waste water from the furnaces will flow into a large basin and be pumped from it into the stand pipe, and a novel system of cooling will be adopted. The overflow pipe will be taken out near the top of the stand pipe and carried with a slight fall to a cooling tower which will be built directly over the basin, and as the difference between the level of the stand pipe and basin is about 10 feet, the available height of the cooling tower will be 60 feet. The water for the furnaces will be taken out of the stand pipe at a point level with the combination water pipes around the furnace boshes, which are about 8 feet above the bottom of the stand pipe.

Lake Superior Iron Mines.

The Republic Iron & Steel Co. and the American Steel Hoop Co. have just organized the Union Ore Co. which has secured a lease of a forty in the Virginia, Minn., district, not far from the townsite. A mine will be opened at once. The ore is of Bessemer quality. The stock of the Union Ore Co. is equally divided between the two companies and the ore will be similarly divided.

It is not now expected, in spite of the early predictions to the contrary, that any shipment of ore from Western Ontario via Port Arthur, will be made this year.

The McGregor Iron Mining Co. which has two forties in section 6, 57-20 on the Mesabi range, is actively at work sinking a shaft. The surface has a depth of 140 feet in the course of the shaft and some time will elapse before mining can begin. Two Webster, Camp & Lane 5-foot hoisting drums have been purchased.

P. L. Kimberly has secured a lease of 160 acres of land in town 59, range 19, Mesabi range, which he has been exploring for some months. The tract is known as the Brodie claim. It is reported that $150,000 cash was paid for the lease.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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THE EXPORT TRADE IN IRON AND STEEL.

The fact that an inquiry for 100,000 tons of pig iron was received by the Tennessee Coal, Iron & Railroad Co. this week, and that sales of about 75,000 tons of Southern iron were made in the preceding 10 days to go abroad, emphasizes what has been said before—that the foreign demand is the key to the situation at home. It only remains for the large steel companies and for the leaders in certain lines of finished material to make corresponding sales to foreign buyers, to put the market on a basis assuring substantially the prices of today for the remainder of the year. Any view that involves a serious slump in iron and steel prices in the United States in the present year ignores the strong reinforcment that is given the home situation by the sustained prosperity of the iron industry in England and Germany. The latter country in particular borders on famine conditions both as to iron and fuel. While there is no doubt that home consumption will be increased by the lowering of prices, there will be hesitancy until something develops to assure buyers that a firmer market is ahead. That something is the sale abroad of considerable amounts of pig iron, steel and finished products. When such sales are made and some of the additional capacity taken on in the past year is provided for, contract buying is likely to be resumed.

That the tonnage of iron and steel exports has been falling off steadily, in spite of the fact that larger values are reported from month to month is made apparent by a glance at the statistics given below. Prices have risen to such a height in the year that the loss in tons sent abroad is apt to be overlooked. Thus, on a March tonnage quite below that of March, 1899, the value of iron and steel exports including machinery, in the third month of the year, is reported at $11,858,387, as compared with $8,834,821 in March, 1899. For the nine months ending March 31, 1900, the total value of these exports was $86,912,155, aganist $67,212,605 and $49,925,199, respectively, in the corresponding periods of the fiscal years 1899 and 1898. We give below the statement in gross tons for March in the two years and for the nine months periods ending with March:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

	March.		July—March.	
	1899	1900	1899	1900
Pig iron { ferro	13		495	
Pig iron { all other	25,209	9,029	243,655	113,367
Scrap	13,717	4,994	64,580	37,189
Bar iron	1,141	371	6,732	6,359
Steel bars (not wire rods)	6,319	1,224	23,763	14,701
Iron rails	1,563	.....	10,731	1,688
Steel rails	17,185	32,808	196,496	227,666
Billets, ingots and blooms	4,299	1,326	33,549	3,824
Hoop, band and scroll iron	770	15	2,120	1,120
Wire rods	917	2,221	17,626	9,035
Iron sheets and plates	1,207	1,243	5,170	5,629
Steel sheets and plates	5,515	2,088	34,415	23,589
Tin plates, terne plates, and tagger's tin	8	9	70	110
Structural material	5,612	6,733	31,780	37,431
Wire	9,589	8,130	65,561	80,524
Cut nails	740	940	11,909	7,349
Wire nails	1,850	3,848	14,662	32,272
Other nails, including tacks	133	211	1,617	1,465
	95,778	75,170	764,871	603,318

The falling off in pig iron, billets and blooms, sheets and plates, and in steel bars, is conspicuous. Rails are the only product showing a notable increase, and structural material stands next. From what is known of the plans of leading steel producers it may be expected that the statistics of the second half of the year will show a material increase both in values and in tonnage.

PERSONAL.

H. W. Oliver, president of the Oliver Iron Mining Co., who presided over the recent Republican State convention in Pennsylvania, is favored by a number of influential Republicans in his State for United States Senator to succeed M. S. Quay.

The American Sheet Steel Co. has made a partial appointment of sales agents in different parts of the country, as follows: W. E. Stockton and E. C. Brainard, Chicago; W. J. Wetstein and John A. Good, St. Louis; S. J. Waterman, formerly of Good & Waterman, St. Louis, at Cincinnati, O.; S. L Mitchel, New Orleans; Hoge & Swift, Portland, Ore.; W. T. Shannon, Chattanooga, Tenn.

Joseph Frantz has been appointed manager of the Piqua, O., plant of the American Sheet Steel Co.

Edward H. Lynde, former superintendent of the North Steel Mill of the Lackawanna Iron & Steel Co., at Scranton, Pa., has been appointed superintendent of the entire North works, to take charge May 1. The position was created for him.

F. L. Grammer, furnace superintendent of the Lackawanna Iron & Steel Co., at Lebanon, Pa., has resigned to assume similar duties at the American Steel & Wire Co.'s Cleveland furnaces. The change took place May 1.

President Felton, of the Pennsylvania Steel Co., has just returned from a trip through Cuba.

Wm. B. Schiller, who has been manager of the National Works of the National Tube Co., has been elected a director of the company, vice Horace Crosby, deceased, and assistant first vice-president. He will have headquarters in Pittsburg. His successor has not been named.

General Manager A. S. Matheson, of the National Tube Co., has not resigned as reported, but has assumed charge of the sales department at New York, retaining his former official relation.

Andrew Carnegie sailed for England, Wednesday, May 2, on the St. Louis.

W. H. Brown Ward, formerly chief clerk of the Monongahela House, Pittsburg, has accepted a position with the American Sheet Steel Co. He will have charge of the offices at Niles and Struthers, O.

Charles E. Cramp, of the Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, was in Pittsburg last week. Accompanied by Vice-President Peacock, of the Carnegie Steel Co., and Superintendent Corey, of the Homestead plant, he visited the armor plate department where plate for

a Russian warship, now on the Cramp stocks, is being made. He denied the rumors that his company proposed entering into any combination with the Carnegie Steel Co. and the many other rumors to the effect that they would operate their plant otherwise than as at present.

Sol Haas, president of the Sloss-Sheffield Steel & Iron Co., has gone to Asheville, N. C., on a three months' leave of absence. His health has not been the best for a year. In his absence T. H. Aldrich, the general manager, will act as president.

Important Conference on Foundry Wages.

The demand of molders in Cincinnati, Cleveland, Detroit, Chicago and other cities west of Pittsburg for an advance of the minimum wage from $2.75 to $3, dating from May 1, is for the moment a matter of chief concern with foundrymen in the Central West. As already noted in these columns, conferences to consider local demands, but which at the same time partook somewhat of a national character, from the presence of foundrymen and molders from other cities, were held previous to last week at Cincinnati and Chicago. Both resulted in complete disagreement between the representatives of the National Founders' Association and those of the Iron Molders' Union. In Cleveland, on Thursday, April 26, a similar conference was held to consider the demand of molders in that city for the $3 minimum. The foundrymen were represented, apart from the district committee, by J. R. Russel, of Detroit; H. W. Wend, of Buffalo, and C. H. Booth, of Youngstown, O. For the molders the conferees were Joseph F. Valentine, of Cincinnati; M. P. Murphy, of Buffalo, and John Loder of Pittsburg. It was agreed by the molders' representatives, after full discussion, to recommend that the men remain at work and hold the demand in abeyance until July 1, and meantime that a national adjustment be made if possible by representatives of the two organizations. At a meeting of the union molders of Cleveland on Sunday, April 29, the above proposition was rejected, but it was decided that there be no strike, inasmuch as a national conference was being arranged for the ensuing week.

In view of President Fox's state of health the officers of the National Founders' Association agreed to hold this conference in Cincinnati. The day fixed was Tuesday, May 1. At this writing no definite conclusion has been reached. It is to be hoped, for the good of the entire foundry trade, both employers and employes, that steps will be taken to insure a continuance of operations. The sentiment among foundrymen, in view of the developments of the past two weeks in the iron trade, is that it would be in a high degree unwise to make the advance demanded. Lower prices for castings are certain, and to make demands for wage advances on a falling market is to go in the face of all economic experience.

National Metal Trades Association.

The second convention of the National Metal Trades, Association will be held on Tuesday, May 8, beginning at 10 a. m., at the Hotel Waldorf-Astoria, New York. The association has had part in a number of important wage negotiations in the past year and in that time has greatly strengthened its membership, having today a total of 109 firms on its rolls. The convention of next week is a very important one, in view of issues raised by the machinists' strikes, some of which are still unsettled.

New Plant of the Bessemer Coke Co.

The Bessemer Coke Co. turned out a quantity of coke at its new Griffin works in the Klondike district of the Connellsville coke region. This gives the company the distinction of being the pioneer in this new field so far as the actual production of coke is concerned. The plant is laid out for a block of 250 ovens, and nearly 100 are completed. The company is now waiting for railroad connections with the Southwest Pennsylvania Railroad, which is building a branch from Lachrone to these works. Analyses of the new product made by Wuth & Stafford, show it to be uniform in character, equal in all respects and superior in some to coke made in other districts of the Connellsville region. The following is the last analysis taken: Volatile matter, .26 per cent; fixed carbon, 89.15 per cent; ash, 9.85 per cent; sulphur, .73 per cent; phosphorus, .009 per cent.

The Blue Mountain Iron Co., whose office is in the Bollitt Bldg., Philadelphia, put its furnaces at Catoctin P. O., Cumberland, Md., in blast on April 23. The company has booked considerable business for its foundry iron and is now an active factor in the market.

PIPE FOUNDING.*

BY ELIOT A. KEBLER.

In an interesting article by Mr. Jesse Garrett, it is stated that cast flange pipe were used on a pump erected under the arches of London Bridge as early as 1582, and that cast iron pipe were used as water conduits in France in 1682; the way these were made has not, however, come down to us. The first pipe were cast in this country before 1830, at Weymouth, N. J., for the 16-inch pumping main of the Philadelphia water works. In that early day the blast furnaces being hardly larger than the cupolas now in use, the molds were rammed up in the casting house and were poured direct from the furnace. Makers of these pipe claimed to know by the appearance of the "bloom," when iron suitable for pipe was tapped, and would divert such iron from the ordinary pig bed to the pipe molds as the run was made. This practice could not be relied upon to give a uniform quality of iron, and the remelting method was adopted. Early methods are sometimes revived, and some 30 years later iron direct from the blast furnace was again used, but the results were not satisfactory.

Until about 1851 all pipe were cast horizontally, or on an angle of about 10 degrees, the mold being rammed up in green sand in a two-part flask. The core was usually made by pressing green sand on a hollow bar which was revovled on its axis, a core board being used to bring it to the proper size. An article by Mr. Ed. Brantlet, an employe of the Brooklyn water works, was published in 1861, in the transactions of the Frankiln Institute. At the two works where Mr. Brantlet inspected, the smaller pipe was still cast on the side, and he discussed quite fully the objections to this mode of casting, either with a green sand core or with one similar to those now in use. As late as 1873 some water pipe were still cast on the side in Pittsburg, and as a molder and helper made the molds and cores for 13 4-inch pipe 9 feet long, each day, a large output was certainly obtained by this method

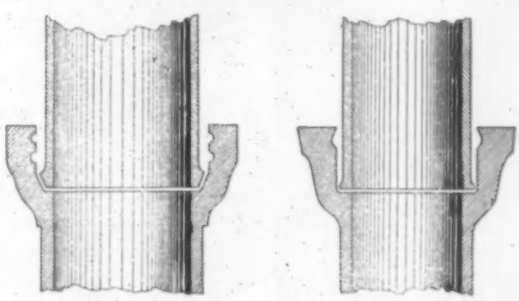


FIG. 1.—ENGLISH PRACTICE. FIG. 2.—AMERICAN PRACTICE.

which seems so antiquated today.

In the English practice the pipe were cast some eight inches longer than the finished pipe, this excess being cut off in a lathe, thus removing any dirt that might have lodged in the top of the pipe, and also leaving the bead end tapering to center the pipe in when laid, there being a corresponding taper at the bottom of the socket. In the American practice no machinery is required, a bead being cast on the spigot end of the pipe, and a wedge-shaped recess on the inside of the socket, this last keeping the joint tighter than when the half circle recess is used as in the English practice. A visit to a modern foundry making water and gas pipe is of much interest to those engaged in the casting of metals, as the large tonnage and quick handling of the tools cannot but appeal to them.

Pit. The pit, which is usually lined with heavy stones, is circular, having a rectangular offset, from one side to facilitate ramming, and having at the end a large rectangular oven for drying the molds. The center of the pit which is built up to the level of the foundry floor, usually supports two cranes, one used principally by the casting gang, the other assisting the rammers.

Flasks. The flasks are of iron, hinged vertically, and are single for large pipe, but for smaller ones, double, triple, and sometimes quadruple flasks are used.

Ramming. The empty flask is placed vertically on the

* Paper read before the May meetings of the Foundrymen's Associations, Wednesday evening, May 2, 1900.

ramming stool, where it is rammed up by hand, a straight pattern being used for the body, the socket being formed by a separate pattern. In some shops the mold is formed mechanically by a taper pattern or a machine which presses the sand against the sides of the flask. The sand used is ordinarily cut over night in the foundry, but the large quantity used as well as the limited space in the foundry, make its removal to another building desirable where it can be screened, mixed and tempered, then being returned as fast as desired by a conveyor. Small pipe are usually molded socket up, the socket pattern slipping over the body pattern, the head being formed in various ways, by a ring set on the ramming stool, a clay cake set into a recess in the bottom of the mold by a rubber bead ring, etc. Pipe over 10 inches in diameter are usually molded socket down, care being taken that the socket cores are well made, as the iron falling 12 feet directly on them, subjects them to such rough usage that formerly it was considered necessary to bottom pour the pipe through a runner extending to the bottom of the mold. After ramming, the flasks are lifted on to casting plates (usually called chill plates), which are clamped to flanges on the bottom of the flasks, and a bucket of blacking is poured through the molds to prevent cutting. In many shops the pipe is rammed up direct on the casting plate.

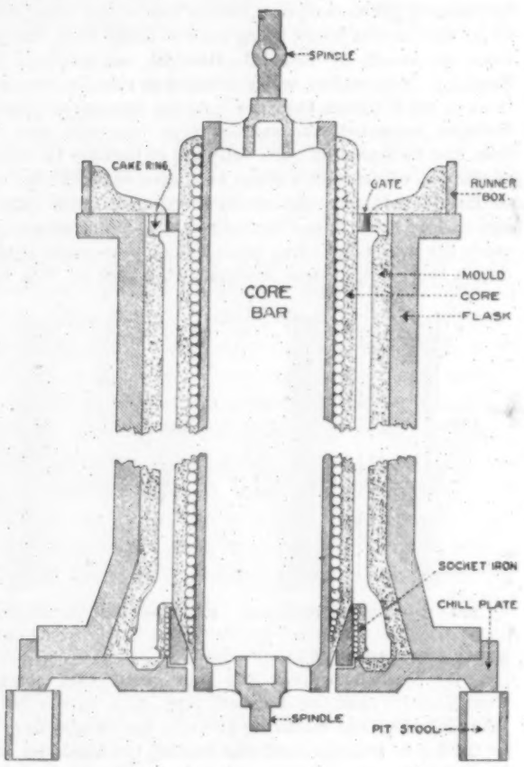


FIG. 3.—SECTIONAL VIEW OF PIPE MOLDED SOCKET DOWN.

Drying. The molds are now placed on top of the oven, and are dried from the inside, as they act like chimneys for the oven, the heat passing up through them.

Core making. While the molds are being rammed up a gang is busy making up the cores, starting with a steel or cast pipe, well drilled for venting as a core bar. These bars are turned by power or hand and a rope spun by an ingenious machine from straw or marsh hay is closely wound from end to end of the bar. A visitor, seeing nearly half a mile of hay rope being used for each pipe five feet in diameter, thinks he ought to take an hour off to show the benighted foundryman some method to avoid this expense, not appreciating that nearly every one connected with the industry, has been laboring for years to do away with the use of the rope. While many core compounds have been tried, and numberless collapsing bars designed to allow the bars to be withdrawn after casting, none, I believe, so perfectly meets the conditions of work here that the use of hay has been permanently done away with in any shop in the United States. The hay on the bar is held in place by a strong first coat of clay on which, when dried, a second coat is struck on, a core board being used to bring the core to its proper size; this board also tapers the cores at the bottom, so that they will center in the casting plate when placed in the mold. After blacking, the cores are placed in the core ovens and dried. In small pipe, the inside of the socket is often struck upon the body core, although a socket core made separately, to slip over a straight body core is preferred by many, as a constant depth of socket is thus assured. For large pipe the sockets are made up separately on an iron socket ring, which fits in a recess in the casting plate, the body core centering in this ring.

Casting. In the morning the dried molds are set around the casting pit, the dried cores placed in them, and dry clay cake rings with gates in them are slipped over the cores to form the top of the pipe and center the cores at the top, and a good sized runner is formed to collect any dirt. In early days but little attention was paid to the kinds of iron used, but now great care is taken in making the mixture and running the cupolas. Some of the works employ chemists who take entire charge of the mixing and melting, they being held accountable for losses originating from these sources. Owing to its fluidity and low shrinkage, Southern iron usually makes up all or part of the mixture used for casting pipe. The iron melted in cupolas is tapped into ladles which, if in (water pipe to a hydrostatic pressure of 300 pounds per square inch), and while under pressure are struck from end to end reach of the pit crane is picked up by it and the molds are poured. If the cupolas are farther away the ladles resting

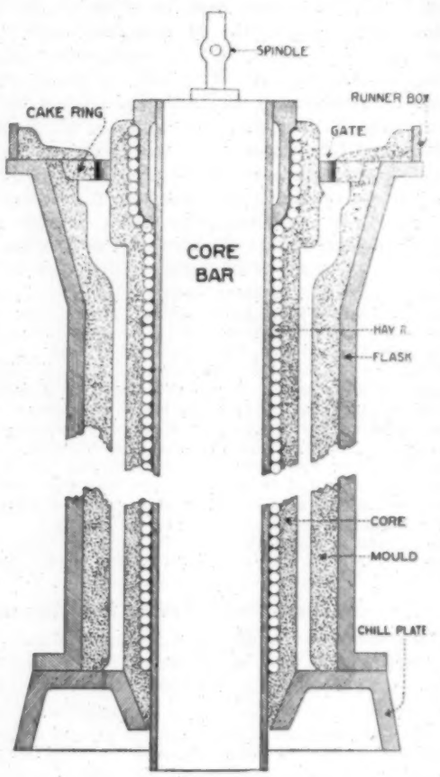


FIG. 4.—SECTIONAL VIEW OF PIPE MOLDED SOCKET UP.

on trucks are pulled within reach of the crane by a small locomotive.

Some years ago a mule, which hauled the ladles of iron, had a way every month or two of slipping into the pit, but the foreman effectually cured him of this the next time he fell in by hoisting him up to the roof a number of times, and while high above the floor, swinging the crane very rapidly.

Stripping. After casting, the core bars are withdrawn, the flasks are hoisted from the pit, chill plates and clamps knocked off, and the pipe dropped out on a skid, the flasks being returned to the ramming pit.

Cleaning. The pipe now roll through the cleaning shed where the cores are cut out with steel rods, fins, etc., are chipped off.

Coating. Pipe intended for water conduits are now heated up and immersed in a preservative liquid, usually gas-house tar, which prevents rusting. All pipe are placed in a press, gaskets placed at each end to prevent leaking, and are tested with a hand hammer to develop any latent defects. The weight is now painted on the pipe and they are sent to the shipping skids. While rectangular pits with overhead travelers, circular pits with revolving linings, and other types are in use, the method of manufacture is in the main as above. Soil pipe being cast very thin, and only about 4 feet long, instead of 12 feet, are cast on the side in green sand moulds and with green sand cores.

NEW VERTICAL SPINDLE MILLING MACHINE.

A new tool has been brought out recently by the Becker-Brainard Milling Machine Co., of Hyde Park, Mass. It is known as the Becker miller No. 5B and is built with reference to a wide range of utility. In general it is on the lines of the No. 6 Becker miller, resembling the latter in every way except size. This type of machine makes possible the use of an end mill working against the piece, which is rigidly supported on the table, and the work in process is under the eye of the operator. The location of the operating mechanism has been studied with a view to putting it within ready reach of the operator so that his attention is not diverted from the work before him. Continuous oiling is secured by means of an oil pump. A considerable range of speed is possible, to suit the requirements of the work, and it is found that many special forms can be produced in from one-fourth to one-half the time necessary for either planer or lathe. Recess work in particular is mentioned, as on this a single mill will do work requiring many successive cuts with the planer or, in the case of a lathe, at least two adjustments. Some details concerning the machine follow:

The spindle has long bronze bearings made adjustable for wear. The diameter at the main bearing is 3 inches. The spindle is bored to Brown & Sharp taper No. 11. Mills are secured rigidly by means of a draw-bar. Large surface mills are fitted to the threaded nose of the spindle. The spindle driving pulley, mounted upon a Becker patent adjustable auxiliary bearing is back geared 5 to 1. The diameter of spindle pulley is 16 inches, 4 inch face. To balance the action, the back gears are made in duplicate.

The head has automatic or hand movement of 9 inches, and an automatic stop dog which will throw out the feed at any point within the limit of its vertical movement, thus giving a vertical boring machine. A micrometer stop-gauge at the upper left-hand side of the frame gauges the depth of cut. The platen is 51½ inches in length over all and 14 inches wide, with 42-inch automatic feed in either direction. There is quick return motion, geared 3 to 1.

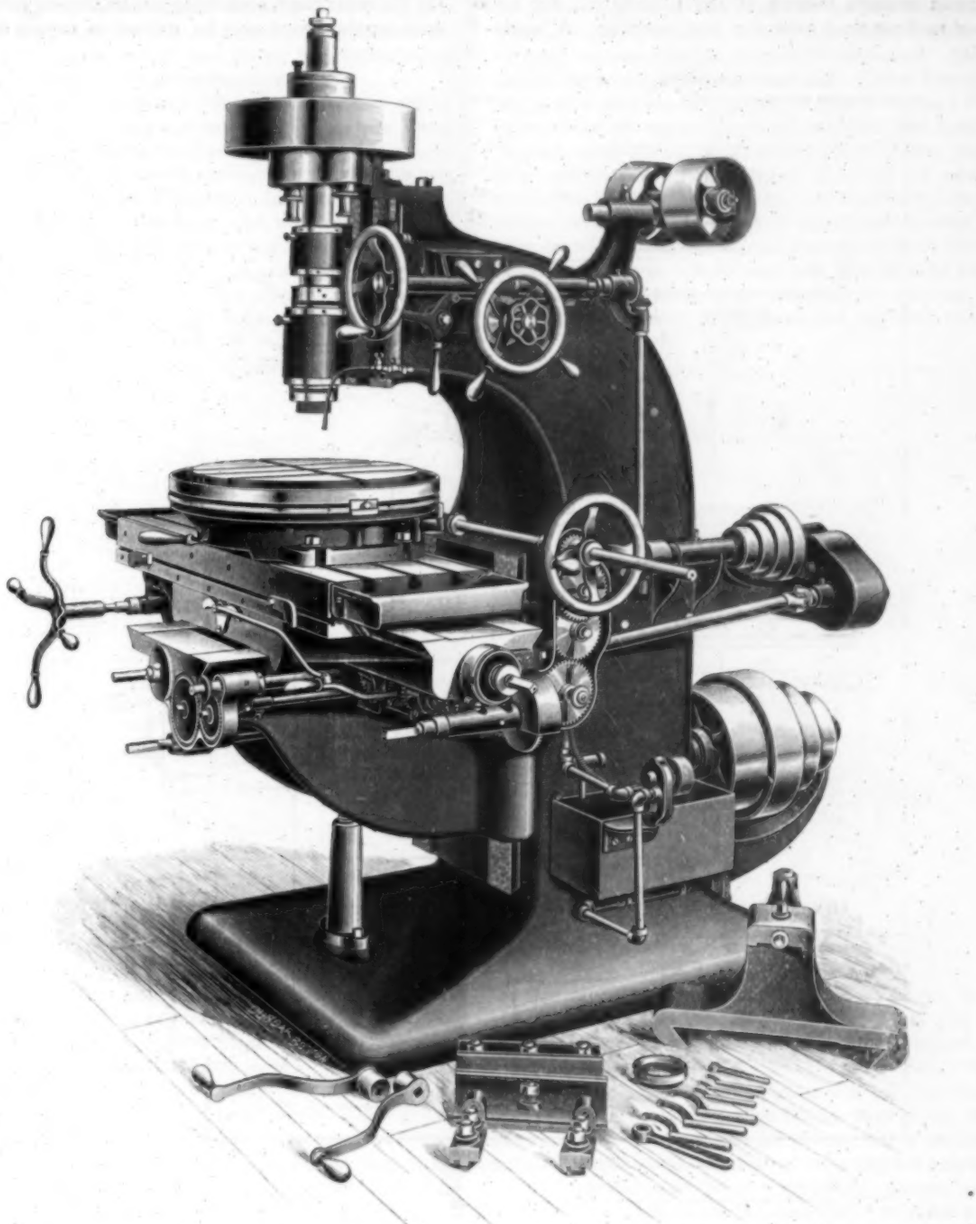


FIG 1.—BECKER-BRAINARD MILLING MACHINE CO.'S VERTICAL SPINDLE MILLING MACHINE NO. 5 B.

The knee has an automatic vertical feed. The extreme distance between the spindle and platen is 21½ inches; between spindle and rotary table, 16 inches. The rotary attachment has a graduated table, 22 inches in diameter. It is fed automatically in either direction. Adjustable dogs are attached to the periphery of the table to trip the feed automatically. Table feeds are derived from compounded gears giving eight changes for each change of spindle speed. The intermediate gears on the rotary feed bracket are interchangeable with each other, increasing the speed 6 to 1, thus providing 16 changes of feeds for the rotary attachment. The arbor sup-

port, attachable to the knee, is only used when side milling with long and slim cutters necessitating a spindle-end support. Vise jaws are 9 inches long and 2½ inches deep, working in connection with the T slots of the table.

Fig. 2 gives a sectional elevation, on which are indicated many of the dimensions of the machine and in Figs. 3 and 4 are shown two of the special forms of cutter whose use is possible with this type of miller.

THE largest orders for machine tools from European countries are those arriving at present from Germany and Austria. The last Berlin mail brought an order to an agent for a German concern located at 120 Liberty st., for two carloads of medium sized tools for iron working. A manufacturers' agent in the Singer Building said yesterday that from Hamburg they had received contracts for upwards of $30,000 worth of machine tools, mostly of Western make. The same parties are bidding on considerable machine shop apparatus and machinery for Trieste, Austria, through their German representatives. One of the best shipments of cranes for the machine shop has just been made to Trieste, valued at $25,000. The high prices of fuel and raw material in Germany, it is stated, is bound to bring many more orders from Germany this season than ordinarily. For this account quotations are being sent extensively. The shipments of all sorts of machine tools to Germany within the next few days, according to lower Liberty st. dealers, will be large.—[Journal of Commerce, New York.

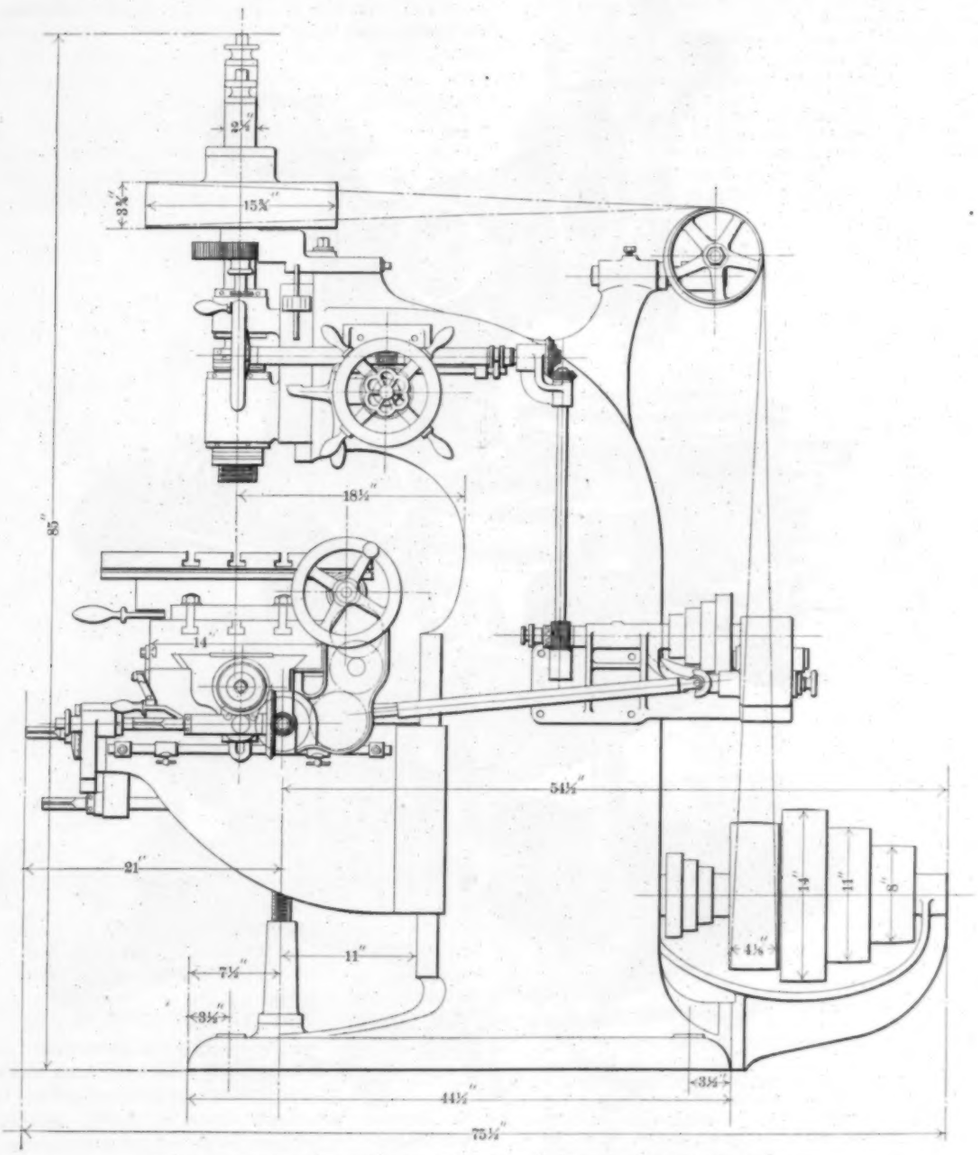


FIG. 2.—VERTICAL SPINDLE MILLING MACHINE. SIDE ELEVATION IN OUTLINE.

POPULAR ILLUSIONS ABOUT TRUSTS.*

BY ANDREW CARNEGIE.

As far as the consolidation of various plants engaged in one branch of manufacture is concerned, this is only obeying the great law of aggregation, which, we have seen, is beneficial, although the real object of the consolidators may, in some cases, have been the belief that through these consolidations ruinous competition might be ended. Color is given to this belief because it is obvious that the cheapening of product cannot result to so great an extent by combining works in scattered places as when one establishment enlarges itself. On the other hand, something is to be allowed for the claim that each separate work may be utilized to supply the wants of a tributary region, thus saving cost of transportation. The one solid enlarged establishment will, however, probably be able to manufacture its surplus not needed in the region tributary to it at a cost so much less than is possible at the small scattered establishments as to enable it to pay the freight upon what it desires to sell beyond its natural territory. Insofar as consolidation of scattered works is intended to save cost of transportation, and thus to produce more cheaply, the consolidation is to be hailed as beneficial for the country; for the foundation upon which we rest is that cheapness of articles leads to their wider distribution among the masses, and is a gain when attained. Reduced

*Extracts from an article in the *Century* for May.

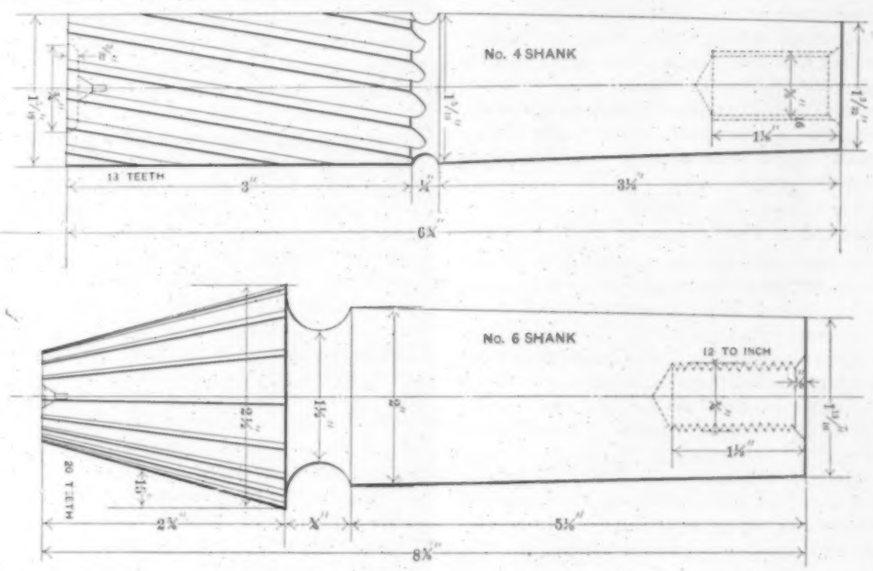
cost of production under the free play of competition, insures reduced prices to the consumer.

The people are aroused against trusts because they are said to aim at securing monopolies in the manufacture and distribution of their products; but the whole question is, Have they or can they succeed in monopolizing products? Let us consider. That the manufacturer of a patented article can maintain a monopoly goes without saying. Our laws expressly give him monopoly. That it has been wise for the state to give an inventor this for a time will not be seriously questioned. So beneficial has it proved that the nations of the world are one after the other following our patent laws. Our chief industrial rival, Great Britain, has done so as far as possible, and the chairman of the British Patent Commission expressed to me the regret that it was found impracticable, at present, to go further, in the same direction.

There are only two conditions other than patents which render it possible to maintain a monopoly. These are when the parties absolutely control the raw material out of which the article is produced, or control territory into which rivals can enter only with extreme difficulty. Such is virtually the case with the Standard Oil Company, and as long as it can maintain a monopoly of raw materials, it goes without saying that it can maintain a monopoly in the product. This is a fact that the public must recognize, but what legislation can do to prevent it is difficult to say. Citizens of the United States have a right to buy anything they choose. This right could scarcely be restricted, nor, upon the whole, would it seem wise to restrict it, since that of the Standard Oil is the only case in which monopoly of an article has been secured. It has been rendered possible only by exceptional ability and in circumstances not likely ever to occur again. The price of its continued success is a line of such able men as its originators. Its second source of strength lies in the fact that through its extensive operations it has been enabled to reduce the price of its product to the consumer. It is a unique organization, for there is nothing like it in the world, and therefore it is not to be classed with the ordinary trusts, which are numerous and are constantly increasing.

Within the last few months a wholly new and surprising development of the trust idea has appeared in the railway world—one which reflects much credit upon the brain which conceived it. This is the purchase by the leading trunk-lines of large amounts of the stock of their less prominent competitors. We now see a vice-president of the Pennsylvania Railroad Company sitting on the board of the Baltimore & Ohio. The possible outcome of this movement, if pursued, assumes portentous proportions, far surpassing in their effect any previous phase of the trust, and may lead to an extension of the powers of the Interstate Commission, and perhaps to other legislation at present unthought of. The subject is too far reaching for more than mere mention in this paper. The country must see its future development, which will be waited with deep concern by the thoughtful student of economic problems.

The genesis of trusts is as follows: Manufacturers of most staple articles (especially of iron and steel) are subject to long periods of serious depression, succeeded by short intervals of high profits. Because during depression no increase is made in capacity, and the world's population and wants are constantly growing, one morning it is discoverd that demand has overtaken and outrun supply. But the production of an increased supply is no easy matter. It usually means beginning at the beginning, obtaining the raw materials from mine or soil, passing these through various processes for which the necessary machinery and facilities are wanting, and it is a year or eighteen months, or even two years, before the supply of most articles can be materially increased. Demand becomes imperious and unsatisfied, and prices bound upward. Many new men are induced to build new works. The extensions of the old works supply all demands, and even a shade beyond; then comes the collapse. It is during one of these long periods of depression, when many of the manufactuers are on the verge of bankruptcy, that there arises in the heart a hope, soon crystallized into a belief, that a new way has been found to avoid the natural consequences of the unchanging economic laws. It is soon felt that savage competition hould cease between those enduring a common affliction, who should be brother manufacturers, and that the lion and the lamb should lie down together. They forget, in the hour of their misery, that the moralist has expressed the fear lest the one may be found inside the other. First, all kinds of understandings and fair promises are made—alas! only to be broken; and finally the promoter makes his appearance, and our unfortunate manufacturers fall an easy prey. Enormous sums are offered for antiquated plants which may not have been able to do more than pay their way for years. These are tied together, and the new industrial makes its appearance as a trust, under the delusion that if a dozen or twenty invalids be tied together vitality will be infused thereby into the mass. This is not true of all that are classed as trusts; there are exceptions. I speak only generally.



FIGS. 3 AND 4.—FORMS OF CUTTER USED WITH BECKER VERTICAL SPINDLE MILLING MACHIME.

Should these combinations be made upon the eve of a period of activity, as was the case recently, then there is a triumphant vindicaion of the new nostrum, the industrial world has found its panacea for all ills, and there is never to be ruinous competition again. The public is alarmed; it hears for a time of the advance of prices in the products of these gigantic concerns, which temporarily control the market, and demands legislation against them. Generally speaking, as in the present instance, the advance in the prices would have taken place even if no trusts existed, being caused by increased demand. The very name of trust stinks in our nostrils. We believe the public to be needlessly alarmed upon the subject, for the following reasons:

Few trusts have a monopoly through patents, or through

the supply of raw material, or of territory, and what happens is this: For a short time competition is hindered, but rarely, if ever, completely stifled. The profits of the trusts are high and capital, ever watchful for an opportunity to make unusual gains, seeks its level by a law of its being, and needs only the opportunity to engage in this highly profitable manufacture. A relative of one of the principal officials or one of the chiefs of a department in the trust, knowing its great profits, gets some friend with capital to build new works in co-operation with him, and the result is that we soon see springing up over the country rival works, each of which has the great giant trust more or less at its mercy. A threat to reduce prices, and the trust, to which this may mean millons of dollars of loss, will sooner or later come to an agreement with the little David who threatens to attack the Goliath, and the rival concern is arranged with or purchased. This only whets the appetite of others who see the success of the first innovator, and other works soon spring up. No sooner has the trust purchased one threatened rival than two appear, and the end is disaster. The people may rest assured that neither in one aritcle nor in another is it possible for any trust to exact exorbitant profits without thereby speedily undermining its own foundations. It is not long since trusts first made their appearance, and already many have disappeared. Many still existing are being assailed, the names of which will readily occur to our readers. Only a few survive today, and none have secured the coveted monopoly. Most of the metals and and many of the staple articles have been formed into trusts, which, although yet living, are rapidly being attacked to their final destruction. The press used to tell every morning of the organzation of some trust or other, and even today we still hear of proposed additions to the list of these attempted gigantic monopolies, which enjoy a brief ephemeral existence. Upon most of them can already be written the appropriate epitaph:

If I was so soon to be done for,
I wonder what I was begun for.

Every attempt to monopolize the manufacture of any staple article carries within its bosom the seeds of failure. Long before we could legislate with much effect against trusts there would be no necessity for legislation. The past proves this, and the future is to confirm it. There should be nothing but encouragement for these vast aggregations of capital for the manufacture of staple articles. As for the result being an increase of price to the consumer beyond a brief period, there need be no fear. On the contrary, the inevitable result of these aggregations is, finally and permanently, to give to the consomer cheaper articles than would have been otherwise possible to obtain; for capital is stimulated by the high profits of the trust, for a season, to embark against it. The result is very soon a capacity of production beyond the wants of the consumer, and as the new works erected are of the most improved pattern, and capable of producing cheaper than the old works, the vulnerable trusts are compelled to buy and capitalize at two or three times their cost. There is thus no danger ahead to the community from trusts, nor any cause for fear.

The great natural laws, being the outgrowth of human nature and human needs, keep on their irresistible course. Competition in all departments of human activity is not to be suppressed. The individual manufacturer who is tempted into the unusually profitable business of the trust will take care of the monopoly question and prevent injury to the nation. The trust, so far as aggregation and enlargement go, is one day to be recognized as a grand step toward cheaper products for the people than could have been obtained by any other mode than the aggregation of capital and establishments Already the ghosts of numerous departed trusts which aimed at monopolies have marched across the stage of human affairs, each pointing to its fatal wound, inflicted by that great corrective, competition. Like the ghosts of Macbeth's victims, the line promises to stretch longer and longer, and also like those phantoms of the brain, they "come like shadows, so depart."

The earth hath bubbles as the water hath,
And these are of them.

The masses of the people, the toiling millions, are soon to find in this great law of aggregation of capital and of factories another of those beneficent agencies which in their operation tend to bring to the homes of the poor, in greater degree than ever, more and more of the luxuries of the rich, and into their lives more of sweetness and light. The only people who have reason to fear trusts are those who trust them.

THE HARVEY PROCESS AND ITS INVENTOR.

An interesting volume, well furnished typographically, is the "Memoir of Hayward Augustus Harvey," prepared by his sons as a tribute to the man and the great work he did in the invention and perfection of steel processes. The book consists of about 100 pages and is illustrated with a number of portraits and other views. Harvey is known the world over for his discovery of the process of surface-hardening steel, particularly as applied to the manufacture of armor plates. Aside from this numerous inventions in steel manufacture give him prominence among modern inventors and scientific men. Between the years 1860 and 1893 he took out 74 patents independently, and several in conjunction with others. Many of these covered certain types of screws and machinery for manufacturing them. Of the Harvey process of surface hardening steel the memoir has this excellent summation: "The so-called 'case-hardening' of small objects had also been known for centuries as applicable to articles of small bulk, but no process of case-hardening seemed applicable to overcome the difficulties encountered in armor making, owing, among other things, to the thinness of the hardened skin or 'case' which was commonly produced, and to the abrupt character of the transition from the harder condition of the external skin to the softer parts under the skin.

"At this point in the history of the development of armor, when all expedients seemed futile to produce the ideal characteristics which had long been suggested, Mr. Harvey solved the problem by the conception and proof that the large mass of an armor plate, if made of homogeneous low steel, could be *deeply* impregnated with carbon upon the compact face, only by prolonged subjections of such a face to the action of carbon under pressure, at a heat in the furnace chamber, high enough to melt cast iron, and that the result of such high and prolonged heat and persistent pressure of carbon on one face while the back was protected, would be to cause such a gradual diminishing percentage in the distribution of carbon inward from the working face, as to obviate all difficulties previously experienced in tendencies to cracking due to the abruptness of the line of demarcation between the harder and softer parts.

"The Harvey process thus, for the first time, made it possible to produce an intensely hard surface on armor, by adapting it to be 'chilled' in the most energetic manner—as by spraying with cold water—without material danger of cracking the plate or its 'glass-hard' face, and without producing any tendency to separate the 'chill' from the soft back. The remarkable adherence to the extremely hard face of a 'Harveyized' plate to a soft body and back, and the efficient yielding or cushioning effect of the back in allowing the hard face to give elastically when struck, and thus throw off and break up the projectile, is doubtless due to the characteristic of gradually diminishing ('decremental') distribution of the carbon behind or beneath the intensely hardened surface layer, which is technically known as the 'chill', and which is formed on one face only, so as to leave the back and sides of the plate free to yield.

"This decremental distribution of the carbon which occurs both in and under the 'chill,' is produced by the high and prolonged heat which results in deep carburization, and it was this practice which was boldly suggested and successfully practiced by Mr. Harvey, contrary to the belief in its practicability by most, if not all, experienced steel workers, who naturally supposed such a treatment would fatally endanger plates of such magnitude."

The Noyes & Rahn Brass Co., of Erie, Pa., will remove from its present quarters on State st. to a new location on West 12th st. The company will have three times its present capacity, but with the rush of business experienced for some time will have no more space than needed. A reorganization has taken place and the company will be known as E. S. Noyes Co.

ADVANCE OF THE GAS ENGINE.*

BY J. D. LYON.

The gas engine as a real factor in the production of power came into existence less than thirty years ago, when the genius of Otto applied to a practical machine the conditions laid down by Beau de Rochas, 14 years earlier. Earlier attempts to transform the heat energy of rapidly burning gases into kinetic energy by allowing them to expand behind a piston were not entire failures, but as is now well known, compression before ignition was the chief novelty in Otto's engine which secured its success. The cycle of Beau de Rochas and Otto is too well known to require a detailed description, and its theory has been very thoroughly worked out in the works of Clerk, Robinson, Witz and others. Early compression gas engines were almost exclusively of the "slide valve" type, with open flame ignition. Fig. 1 illustrates this type of gas engine. The improvements made since the time of the slide valve engine have been very marked, but the principal upon the latest designs operate is exactly the same as that of the first compressing engine. The manufacture of the gas engine was commenced in America soon after the Centennial Exposition in 1876, where it was first exhibited in this country. The introduction here was much more difficult than in Europe, no doubt owing to the relatively low cost of coal in the United States. Small sizes only were constructed at first, and by degrees a demand was created for them for a great variety of uses. The price of illuminating gas was the greatest obstacle in the way of their introduction, being in many cases as high as $2 per 1,000 cubic feet. The gas consumption of a slide valve gas engine of 15 h. p. was about 22 cubic feet per B. H. P. hour, exclusive of the small lighting flame. The efficiency of such an engine would thus be nearly 18 per cent if the gas ignited in the engine is alone considered This is much higher than steam, even in large capacity, but the cost of equal calorific values in gas and coal show a large balance in favor of the coal. Several thousand of these engines were put in use in this country before their final abandonment in favor of the poppet valve engine, the largest size being, I believe, about 25 h. p. These engines were applied to almost every conceivable work for which small power is required, but in such work as operating printing presses, small shops, pumps, and elevators, was found their field of greatest usefulness. It is interesting to note that even in this stage the gas engine has become a factor of considerable importance in many industries, although it had in a large number of cases replaced hand power only.

*Read before the April meeting of the Engineers' Society of Western Pennsylvania, at Pittsburg.

In our interest in the results obtained with large gas engines we are likely to forget the greater aggregate value of the small engines now scattered over the country in greater numbers.

Some time ago the *Gas World* published the following: "It is said that the distribution of 2,323 gas engines throughout thirty-six representative German cities is as follows, the cities ranging in population (1890) from 3,000 to 348,000, with an average of 68,000:

Printing and lithography	14.4 per cent.
Pumping	8.6 "
Textile	7.9 "
Electric lighting	7.6 "
Machine shops	5.3 "
Joiners and cabinet makers	5.0 "
Butchers and sausage makers	5.0 "
Locksmiths	4.2 "
Coffee roasters	3.1 "
Cutlery	2.9 "
Elevators	1.6 "

"The remaining 34.4 per cent is scattered throughout 140 more industries. This would seem to prove that the gas engine is the motor of small industries; but it must be borne in mind that Germany is the land of small industries."

I am not aware of the date upon which these figures were accurate, but I should say that an investigation of an equal number of installations in this county will show quite as wide a range of work.

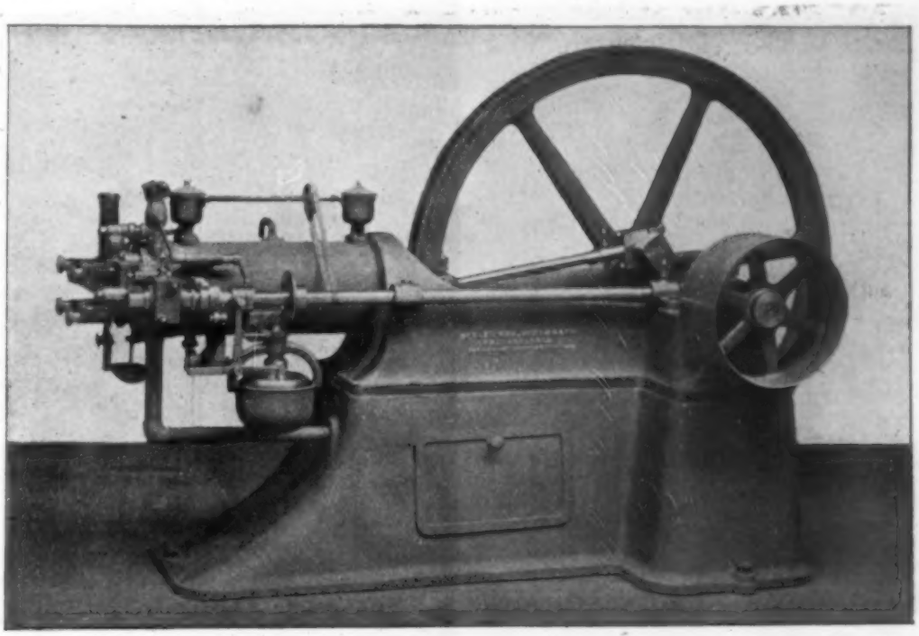


FIG. 1.—EARLIER TYPE OF GAS ENGINE.

Advantages of the Gas Engine.

Reasons other than economy of fuel frequently lead to the use of the gas engine, among them being the small amount of attendance required in operating it. This one point is mentioned for the reason that while it has been responsible for the purchase of many gas engines, and exaggerated value placed upon it has been a prolific source of trouble. Lack of intelligent attention is responsible for more unsatisfactory gas engines than all other causes combined. Because the gas engine will run with little attention, it seems unreasonable to some owners to think that its bearings will cut, when run without oil for only a half hour or so, or that failure to turn the water into the water jacket at starting should prove disastrous. However some real knowledge of the gas engine is now to be found among the engine room attendants, and troubles of the character mentioned are becoming fewer. Further, in justice to many gas engine owners it is well to say that they have been in some cases misled, unintentionally, by salesmen failing to impress upon them the importance of careful, systematic attendance.

It is probable that the origin of some of the prejudices existing against the engine today can be traced to the peculiar difficulties encountered in the use of the slide valve engine.

It was in comparison with the modern poppet valve, electric igniter engine, both sensitive and capricious, although in the hands of a man who understood it, the results obtained were good. Slide valve engines never proved successful to any extent with natural gas. That they were good engines is proven by the fact that many are still in operation, on illuminating gas. With the introduction of the poppet valve and better form of igniter, the compression of the charge of gas and air was greatly increased, the result being higher mean effective pressures, which, combined with the higher speeds made possible by the change, increased the power obtained from a cylinder of given size, and rendered the construction of large engines less difficult. The consumption of fuel was also decreased, and at the same time the use of new and cheaper fuels became a possibility.

Fuels Employed—Blast Furnace Gas.

The principal gas engine fuels are as follows: the order in which they are named indicating in my opinion their relative importance in the vicinity of Pittsburg: 1 Natural gas. 2 Blast furnace gas. 3. Producer gas. 4. Illuminating gas. 5. Gasoline.

Natural gas being of high calorific value, cheap and well distributed, becomes an almost ideal gas engine fuel, and one with which it can compete against the steam plant, even when fuel cost alone is considered. With natural gas at about 1,000 B. T. U. per cubic foot, I have obtaind one B. H. P. hour with less than 12 cubic feet on test with a 20 h. p. gas engine. As this gas varies considerably in calorific value, it is not safe to assume that this economy can be expected in practice. With a Junker's calorimeter I have found a variation of from 925 to 1,137 B. T. U. per cubic foot, in the gas n Pittsburg and Allegheny. 1,000 B. T. U. per cubic foot is the value usually assumed, and it is reasonably near the average. Assuming 13 cubic feet per B. H. P. hour, the engine efficiency will be very little under 20 per cent. Nearly all gas engines in the vicinity of Pittsburg are employing natural gas, and this will probably continue so long as the supply holds out and prices remain reasonable.

In the list of gas engine fuels, blast furnace gas is ranked as second in importance, although its application must of necessity be limited to a small number of installations, but of large capacity. It will be readily seen that the gas engine using this gas could never assume the position of general importance it now holds with natural gas. It has been ranked as second because of the probable effect in the future upon some of our largest local industries which are centered about the blast furnaces. I do not know of any gas engine installations in this country as yet arranged for the utilization of the blast furnace gases, but in Europe the progress has been so great that it can only be a question of time until the practice has extended to this country. At present the largest gas engines in the world are using this fuel.

Fig. 2 shows a tppe adopted by the Gasmotorenfabrik-Deutz for blast furnace gases. This concern was founded by the late Dr. Otto himself, and it has always held a leading place in all gas engine development. In the use of this fuel the value of compression previous to ignition is well illustrated, as the gases containing so low a percentage of combustible that they will hardly burn with certainty under a boiler, ignite with reliability in the cylinder of the gas engine, when compressed to say 110 pounds per square inch. The fear that the fine metallic dust carried by the blast furnace gas would prove an insurmountable obstacle in the way of their use, has not proven well grounded. Scrubbers of the simplest character eliminate this dust to such a degree that the small amount remaining passes out of the cylinder harmlessly with the exhaust gases. In one instance a small experimental engine ran 16 hours per day for four months without cleaning.

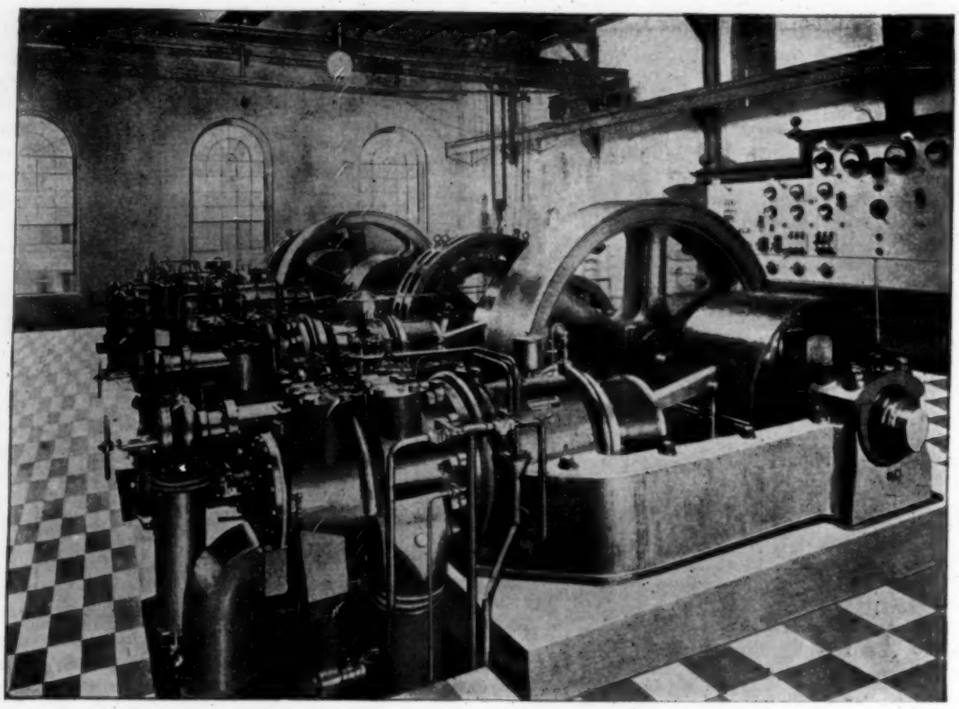


FIG. 2.—ENGINES USING BLAST FURNACE GAS AT GERMAN WORKS.

Mr. Wilhelm Spiecker, commercial director of the Gasmotorenfabrik-Deutz, when in this country a few months ago, informed me that the most careful measurements upon blast furnace gas engines after several months' service fail to show any undue or exceptional wear upon the cylinders or pistons. That this new branch of gas engine development has passed successfully its experimental stage is evident from the rapidity with which European blast furnace managers are placing orders for large sizes. The company just mentioned had up to last fall booked orders for about 12,000 h. p., in addition to a number of plants already installed. Among the largest plants are those at Oberhausen, and the Duedelinger Iron Works, Luxemburg. The former consists of one 600 h. p. and two 300 h. p. units, all double cylinder. The latter plant consists of two 1,000 h. p. and one 500 h. p. unit.

The largest single cylinder gas engine ever built has been in operation in Belgium since last September, as a blowing engine. The cylinder of this engine is 51.1 inches by 54.1 inches. An excellent description of this engine and its performance will be found in the *Engineer* of recent date. With the benefit of foreign experience and the assurance given by precedent, it would seem that great strides should be made in this most economical method of utilizing that portion of

the blast furnace gases devoted to the production of power. Nearly five times as much of this gas fired under a boiler is required to produce a given power as would be required in a gas engine, thus leaving after the performance of the present work, a large surplus for other purposes. By electrical transmission, this power may be conveniently delivered at any desired point within a reasonable distance with very slight loss. The average calorific of blast furnace gas is about 100 B. T. U. per cubic foot, and its consumption in the gas engine varies from 95 to 115 cubic feet per B. H. P. hour.

Producer Gas the Solution of the Fuel Problem.

Passing on to the next fuel, producer gas, I will say that I believe this is to be to a great extent the final solution of the gas engine fuel problem, as far as the general use of large engines is concerned. Already several plants are in operation in this country and many in Europe with efficiencies higher than the best steam plants. Seven years ago a test by Prof. Spangler (see Journal of the Franklin Institute, May, 1893) showed a consumption of 1.3 pounds of coal per B. H. P. hour in a producer furnishing fuel for a 100 h. p. Otto gas engine. This result has since been improved upon, until an economy of a little over one pound per B. H. P. has been attained. Up to this time anthracite coal and coke are the only fuels available in the producer for gas engine service, since an unwarranted expense is necessitated to produce a fixed gas from bituminous coal. It is probable that bituminous producers will be made at a cost which will warrant their installation. When such a time arrives, the gas engine and producer will be purchased exactly as the steam engine and boiler of the present, but with the assurance of far higher efficiency, consequently lower fuel cost, lower cost of attendance, and greater safety. One pound of good anthracite coal will make about 90 cubic feet of gas, having a calorific value of about 137 B. T. U. per cubic foot. Prominent examples of the use of gas engines with producer gas are the Danbury, Connecticut, 300 h. p. and the Erie R. R., Jersey City, 425 h. p. plants. To show the general arrangement of a producer for this purpose, I take the liberty of using an illustration, Fig. 4, from the catalogue of R. D. Wood & Co., who have furnished the producers in the plants mentioned.

Illuminating gas comes next in the list of fuels, and as stated before, it is responsible for an enormous number of small engines and some of larger capacity scattered over the entire civilized world. While neither so special nor so localized as natural gas, illuminating gas for fuel requires that the user reside within a certain distance of the gas main With the movement to reduce the price of fuel and power gas, illuminating gas becomes more interesting as a possible fuel for large engines. Cincinnati has had 50 cent gas for about one year, and according to the *Gas Engine*, published in that city, many engines previously operated with gasoline are now run with gas, some 350 h. p. being thus effected. However, with gas at $1 per 1,000 cubic feet, the gas engine in large units can never compete with steam unless some peculiar conditions render steam costly at any price. In smaller units the case is different, owing to a disproportionate amount of skilled attendance required by the steam plant, and to a gas engine characteristic which will be mentioned later, namely, the regulation of fuel to conform with the work done. Most small engine users have only intermittent use for their machines, and greatly varying loads, both of which conditions would point to gas as the most desirable power, and probably the most economical even in fuel.

Gasoline which is placed last in importance in this district favored with cheap gas, stands easily first over a large portion of the country. Its introduction as a gas engine fuel opened a new and wide field for the engine by making it available beyond the limits of city gas mains. Thousands of gasoline engines are in use upon the same wide variety of work as the gas engine, but with new uses added. In the Northwest small gasoline engines are used by hundreds in the country grain elevators, and are popular in larger sizes in flouring mills and small water works for towns and villages. Several railroad companies have begun the replacing of steam tank pumping stations with gasoline engines. I have been informed that a single company has installed 35 from one manufacturer in the last year. Small gasoline engines also find favor in the pumping of mines. It is plain that in such a case fuel cost is not the point considered. The facts that they can be placed almost anywhere in the mine and do not require constant attendance, are greatly in their favor. Some astonishing savings are occasionally effected by the displacement of manual labor with the gasoline engine.

The total operating expenses of a small pumping plant in the Oak Station mine of the Pittsburg & Castle Shannon R. R. Co., for eight months, show a rate of saving which amounts to about $1,100 per year on an investment of less than $800. In this case a 3½ h. p. engine and directly

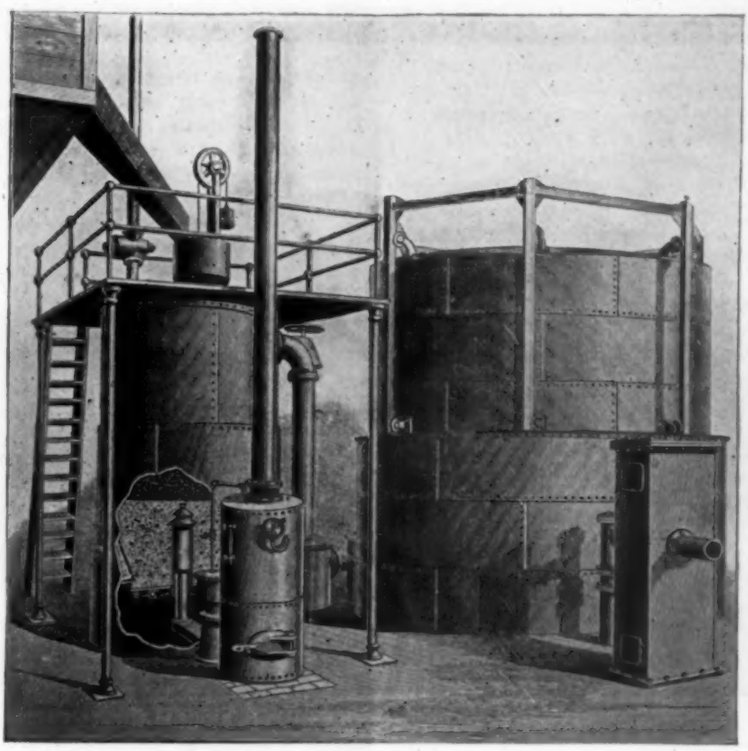


FIG. 3.—WOOD GAS PRODUCERS FOR GAS ENGINE PLANTS.

coupled triple pump clears the mine of water in 1¼ hours' work each day. Two men at $1.75 each were formerly required to do this work, working seven days in the week. No trouble is experienced with installations of this kind, if provision is made for the rapid carrying off of the exhaust gases to the open air, and if proper precautions are taken at all times in handling the gasoline. I believe the limit of quanitity of gasoline allowed inside a mine should not exceed say from three to five gallons, which quantities would represent about 24 to 40 B. H. P. hours respectively. The smaller quantity in most cases of clearing a single mine in this vicinity would do a day's pumping.

Assuming the fuel consumption of the gas engine at the quantities usually estimated, the cost of one B. H. P. hour with the various fuels would be as follow:

Natural gas at 25c per M. cubic feet	0.325c.
Producer gas, 1.3 pounds coal, at $5 per ton,	0.325c.
Illuminating gas, 650 B. T. U. per cubic foot, $1 per M. cubic feet,	1.7c.
Gasoline, ⅓ gallon per hour, at 12c.	1.5c.
Steam, 5 pounds of coal per B. H. P. hour, coal $1.10 per ton,	.275c.

This comparison, showing the coal to be cheaper when fired under a good boiler in a plant of fair size, is a misleading one when the actual plant in operation is considered. If it were possible to operate gas and steam engines with the fuels named at the prices given, and at a condition of constant full load, the comparative results would be represented with fair accuracy. Under conditions of practice in which there are considerable fluctuations in loading and the average load is considerably below the maximum, the saving of fuel by reason of the lighter load will be very small in the steam engine.

With the gas engine, the governor acts directly upon the fuel supply and the quantity of fuel used in performing an average work a for n units of time will be nc (f+a) in which "c"=fuel consumed per I. H. P. hour and "f"= the friction load of the engine (or, I. H. P.—B. H. P.). This is probably more nearly true of engines governing upon the "hit and miss" principal than in any other type, since all impulses are exactly the same in power, and the thermal efficiency is the same. It is this valuable characteristic of the gas engine which causes operating expenses to be over, rather than underestimated in many cases, as when the maximum load is known it natually forms a basis of calculation.

Very large gas engines are now being made in this country, the largest of all in Pittsburg, at the well known Westinghouse works, and we have recently become accustomed to speak familiarly of gas engine units and plants the size of which we should have considered extremely large a few years ago.

Pennsylvania Malleable Co.'s Gas Engine Plant.

The installation of the gas engine in large industrial plants has so far been chiefly auxiliary, although numerous concerns using as much as 100 to 150 h. p. are dependent solely upon it. Among the first large concerns, and the first of its kind to accept the gas engine as the most satisfactory solution of the power problem, is the Pennsylvania Malleable Co., of this city, in their new works at McKees Rocks. The decision in favor of the gas engine was reached after careful consideration of the power needs of the works and a searching inquiry into results obtained from gas engines upon a large variety of work. The prime consideration of economy was found to be in favor of the gas engine; the reliability in a properly designed plant to be equal to steam, while convenince, flexibility, and low cost of attendance were all favorable to the gas engine. The plant when finished is to consist of 12 engines of 60 h. p. each. The first installation is of 360 h. p., 240 h. p. more is to be added, within a short time, and if found necessary, the remaining 120 h. p. will be placed. Fig. 5 shows approximately the type of Otto engine employed.

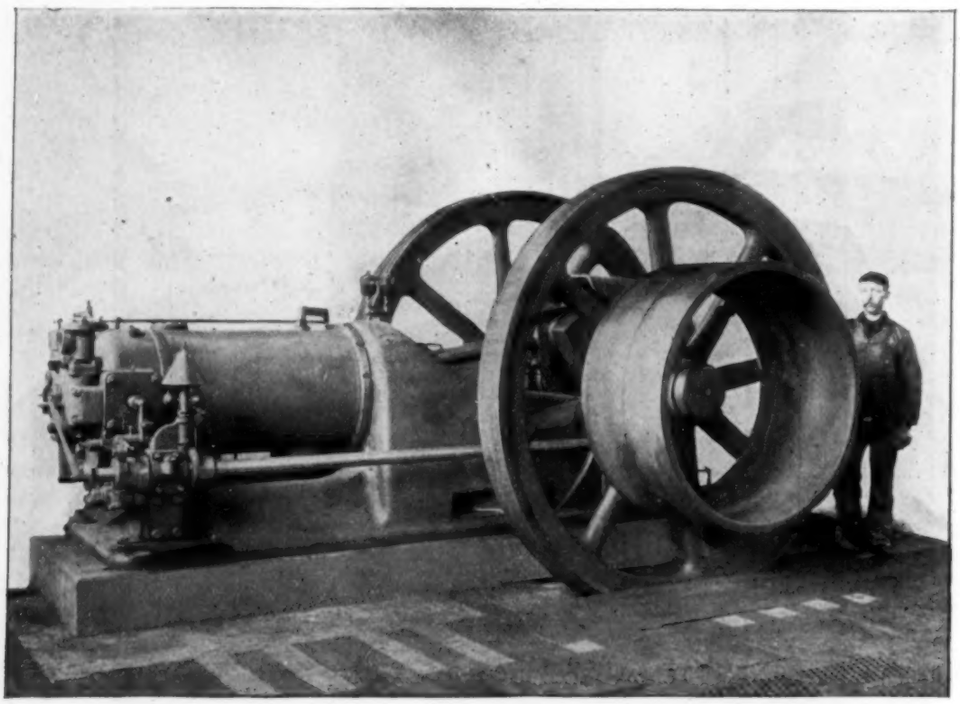


FIG. 4.—GAS ENGINE OF LATEST TYPE AT OLIVER IRON & STEEL CO.'S PLANT.

The engines are arranged in pairs with cylinder heads about 6 feet apart, leaving an aisle of convenient width for the attendant. Two line shafts are operated, one on either side of the engine room. Engines and all engine room machinery except pumps are belted to friction clutches upon line shafts. For pumps ordinary tight and loose pulleys are used. The machinery of this room consists of four generators, two blowers, ad the pumps to which reference has been made. All machines rest upon concrete foundations built up from level or solid ground to the floor, a distance of about nine feet. Floor stands for shafting also rest upon concrete piers. The foundations under each opposite pair of engines are connected through, below the floor level, securing entire freedom from the rocking or vibration, which so frequently mars the effect of an otherwise admirable installation. Gas is supplied from an 8-inch line carried over from the wall of the building to the center of the engine room, being supported by the roof trusses. Over the center line of each pair of engines is placed an 8x2½-inch cross tee, from which connection is made to the engine through a pressure regulator. Water is supplied to the water jackets from an

overhead tank, into which water is pumped from wells. The exhaust pipes are run horizontally until they extend beyond the foundation. They are then carried downward and after passing through two exhaust vessels, are further carried horizontally under the floor to the side wall of the building, along the inside of which they pass vertically through the roof.

Power will be transmitted from the engine room by shafting for the machine shop, grinding and fitting department and the rolling room, estimated to require altogether 250 h. p. Blowers and pumps are estimated at 50 h. p. Twety-five motors having an aggregate capacity of 700 h. p. deliver power to the various departments. Among the purpose for which motors are employed are cranes, elevators, conveying systems, machine tools, etc. While the total power required to operate all machines at maximum capacity at the same time amounts to over 1,000 h. p., it is considered perfectly safe to assume 700 h. p. as the working maximum with all machines now installed or in contemplation at this time. The periodic variations of load will be great, ranging from the power of a single pair of engines at night to a probable full load during the earlier and latter part of the day. This large fluctuation in load was the principal reason for the subdivision of the plant into such relatively small units. No tests have yet been made upon the engines already installed, and as the entire plant is not in operation, it is impossible to give the actual running cost.

The concern being large users of natural gas for various purposes, secure the advantage of lower price for gas than the usual rate to consumers. Basing calculation on a gas consumption of 13 cubic feet of gas per B. H. P. hour, and a rate of 10c per 1,000 cubic feet, the cost of operating under full load of 700 h. p. would be $0.91 per hour. The most favorable conditions under which steam could be employed, with present prices of coal considered, can not equal this in economy. The excellent arrangement of this department is due to the combined skill of Dr. R. G. Moldenke, foundry superintendent, and Mr. S. H. Stupakoff, general superintendent of the Pennsylvania Malleable Co. If the excellent results obtained so far continue as more of the plant is put into service, and there can be no valid reason why they should not, the service it will do the gas engine will be of great importance.

Among other large local concerns in which the gas engine as auxiliary and in one or two cases principal power has been adopted are the Oliver Iron & Steel Co., three engines; Baker Chain & Wagon Iron Co., Howard Axle Co., Zug & Co., Pittsburg Screw & Bolt Co, and many others. Several manufacturers of engines are represented in this short list. Photograph 4 was taken from the larger of two engines furnished the Oliver Iron & Steel Co. It is a single cylinder engine, developing 114 B. H. P. on illuminating gas of 650 B. T. U. per cubic foot. It is interesting to compare this engine with its lineal prototype shown in Fig. 1, as both were developed in the same shops, with a lapse of time of over 20 years.

Indications now point to a far greater development in the next 20 years, and unless some revolutionizing discovery in power production checks its growth, it seems inevitable that the gas engine will supersede steam, in moderate sizes, at least.

THE Navy Department is considering the feasibility of employing gas engines in the navy. A series of experiments is now being conducted by a large manufacturing concern. In general the plan is to propel the engines by gas produced by roasting coal in retorts on ship-board. The purpose of the experiments is to ascertain whether the weight of the gas producing plants and gas consuming engines are much less than the ordinary plant of steam boilers and engines and the saving of space sufficient to warrant the adoption of the system.

ONE of the plans said to be in prospect for consideration by the next annual convention of the Amalgamated Association of Iron, Steel and Tin Workers, which meets on May 15, in Indianapolis, is to demand a shut-down of all mills during July and August. The idea is said to be to keep the present wage scale up, by curtailing production, instead of demanding an increase in the scale.

PPODUCTION OF WIRE RODS IN 1899.

The American Iron and Steel Association has ascertained from the manufacturers that the production of iron and steel wire rods in the United States in 1899 amounted to 1,099 376 gross tons, against 1,071,683 tons in 1898, and 970.736 tons in 1897, showing an increase of only 27,693 tons, or a little over 2.5 per cent, in 1899 over 1898. As compared with 1897 the increase in 1899 amounting to 128,640 tons, or over 13 per cent. The production of 1899 was the largest in our history. Pennsylvania made the largest quantity in 1899, with Ohio second, Illinois third, and Massachusetts fourth. Three other States, New Jersey, Kentucky and Indiana, also rolled rods in 1899.

We still import considerable quantities of the finer grades of iron and steel wire rods, particularly steel wire rods, our total imports of rods amounting to 17.964 gross tons in the calendar year 1899 and to 15,985 tons in 1898. Our exports of steel wire rods amounted to 16,992 tons in 1899 and to 18,510 tons in 1898.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Benniwell-Calvin Iron Co. has been incorporated at Kansas City, Mo., with capital stock of $100,000, by John Calvin, F. B. Benniwell and W. H. Grant.

The G. A. Kelly Plow Co., of Longview, Tex., has been incorporated, to manufacture agricultural implements, by G. A. Kelly, J. U. Yates, R. M. Kelly and others; capital stock, $50,000.

W. D. McNeill, Warrenville, S. C., is in the market for a 1,000 h. p. cross-compound condensing engine.

Seneca Iron Works, Seneca, S. C., wants to correspond for second hand lathes, shapers and planers.

E. F. Stafford, North Wilkesboro, N. C., will buy second-hand double or four sided planer and boring machine for boring railroad cross-arms.

Richmond Screw & Bolt Co., Richmond, Va., asks prices on screw cutting machines from one-half to three inches long, bolt and nut machines, steel and iron rods.

B. L. Berkey, manager El Paso Mine, Mill & Smelter Supply House, El Paso, Tex., will buy punch and shear to punch not less than ⅝-inch hole through ½-inch metal; also set of rolls for sheet metal.

New Construction:—

The Kinnear Mfg. Co., Warrn Pa., is building a large addition to its works, for the manufacturing of acetylene gas generators. The company's capacity will be doubled.

The Lane & Bodley Co., of Cincinnati, report an increased demand for their engines from all parts of the world, especially from the cotton belt of the South where a number of mills are being erected. A growing demand for the Corliss engines comes from China. At present the company is building an 18x32x48 cross compound, condensing, heavy duty rolling mill engine for the Simonds Saw Mfg. Co., of Chicago.

The Birmingham Pipe & Casting Co., of Birmingham, Ala., recently incorporated with a capital stock of $50,000, will be ready within two months to turn out a complete line of soil pipe and fittings, plumbers' castings and jobbing castings. The Baxter Stove Works have been rebuilt and repaired for the new plant. A large output is promised. E. W. Abrams is president and F. E. Glenn, secretary and manager of the company.

A large foundry will be erected at Baldwinsville, N. Y., by W. F. Morris.

Dillon-Griswold Wire Co., Sterling, Ill., is preparing to increase its capacity from 100 to 250 tons per day, and for the addition of 20 new woven wire fence machines. Its mill is again in operation.

The Longmead Iron Co, of Conshocken, Pa., will increase its capital from $100,000 to $400,000, and enlarge its plant to employ 150 additional men. It will also absorb the Conshocken Tube Co.

The plans of the Norway Iron & Steel Co., York, Pa., call

for a foundry 246x80 feet; an annealing house 220x65 feet; a two-story brick building, 140x40 feet, with warehouse, machine shop, carpenter shop, pattern shop and tumbler room, a two-story brick office and chemical laboratory, also engine house, sand house and brick storage house.

The Manville Covering Co., of Milwaukee, Wis., has recently completed a six-story addition, 100x150 feet. This will enlarge considerably its facilities for manufacturing steam pipe and boiler coverings, as well as different grades of asbestos goods, roofing, etc., and will add about 200 men to the company's working force.

Architect P. F. Jeckel has prepared plans for a two-story brick building, 28x60 feet, for the Anderson Foundry & Machine Works, at Anderson, Ind.

Architect Thomas Campbell has prepared plans for a frame and brick extension, 210x140 feet, to the plant of the Central Foundry Co., Vincennes, Ind.

Bids are now being received for the new factory of the Boyer Machine Co., St. Louis, Mo. Cost, about $100,000.

Plans are being made for additions and alterations to the plant of the Kelly-Jones Co., of Greensburg, Pa.

The Globe Mfg. Co., of Battle Creek, Mich., has added a brass factory to its plant.

W. H. Ottemiller has started a new machine shop at York, Pa.

The American Car & Foundry Co., of Depew, N. Y., are erecting a building, 600x80 feet, to be used as a paint and repair shop.

Cuyler & Mohler, dealers in machinists' supplies, will erect a five-story warehouse at 309 West Fayette st., Baltimore, Md.

The contract for enlarging the plant of the Erie, Pa., Malleable Iron Works has been awarded to William Ackerman. Cost, $11,000.

The Michigan Central Railway will build a new boiler shop at Jackson Junction, Mich., at a cost of $50,000. An electric light and steam heating plant will also be added, which will cost $30,000. Work will be begun at once and it is expected the buildings will be completed this summer.

In case the contract for the new Cincinnati water-works machinery is let to the Holly Mfg. Co., of Lockport, N. Y., a new foundry will be built at Cincinnati, by the Laidlaw-Dunn-Gordon Co., to make castings for the Holly company.

The Detroit Steel & Spring Co. of Detroit, Mich., has plans for a 475x126 foot brick manufactory to cost $25,000.

The Columbus Iron Works Co. will establish a $300,000 plow works at Birmingham, Ala.; G. W. Brown, secretary and treasurer.

Efforts are being made to take the Standard Automatic Gas Engine Co , of Oil City, to Youngstown. Bids are being received for the construction of a plant 80x300 feet, fitted throughout with modern machinery. Youngstown parties are said to own most of the Standard stock.

The R. S. Newbold Sons' Co., Norristown, Pa., is enlarging its foundry by a 40x60 steel frame addition. The Newbold Co. is engaged in getting out the machinery for the new sheet mills of the Sharon Steel Co. and has several other contracts on hand.

The Pittsburg District:—

The Penn Gas Coal Co., has 50 coke ovens ready for firing at Penn Station, near Irwin, Pa. A plant of 50 more will be built this summer.

By the bursting of a boiler, operated by Drake & Stratton, contractors, at Rankin, Pa., last week, five laborers were seriously injured and one killed. The men were at work making an excavation for one of the piers for the new "hot metal" bridge for the Carnegie Steel Co. to span the Monongahela river and connect the Carrie furnaces with the Homestead steel plant.

The converting and rolling mill departments of the Duquesne plant of the Carnegie Steel Co. were closed down several days last week to permit the installation of four electric cranes, built by the Morgan Engineering Co., of Alliance, O. Other machinery was also added, made necessary by increasing the number of soaking pits from nine to fourteen.

The Pittsburg Chain Co., recently organized, has leased the building formerly occupied by Velte & McDonald, founders, Liberty ave. and Thirty-second st., Pittsburg. The building is 120x100. Another of a like size will be immediately erected. Application for a charter will be made May 10. The capitalization will be $25,000. The list of incorporators was mentioned in our previous issue.

The Lewis Foundry & Machine Co., Pittsburg, will break ground in a few days for their new plant, just south of Coraopolis, Pa. It is probable that the Pittsburg plant will be removed to the new site at some future time.

The Pittsburg Bridge Co. has completed the steel frame work for the new structure of the Braddock Machine & Mfg. Co., Braddock, Pa. The foundry department and mold shop will be put into operation within a week.

William A. Stanton, of Pittsburg, purchased 2,882 acres of virgin ganister land near Hollidaysburg, Pa., last week. Extensive quarries will be opened. The stone will be marketed in the Pittsburg and Johnstown, Pa., districts.

Owing to the placing of a contract by the Carnegie Steel Co. with the Morgan Construction Co., of Worcester, Mass., for a billet mill and two merchant bar mills, it was rumored that the steel company would soon be a competitor of the American Steel & Wire Co., by commencing the manufacture of rods. These reports are officially denied, however. It is stated that no such move is contemplated and that it is absurd to construe a contract for billet and bar mills in the way that had been done by the press.

The Frank-Kneeland Machine Co., builders of iron and steel works machinery, recently installed a 36-inch blooming mill in the Schoenberger works of the American Steel & Wire Co., at Pittsburg, together with tables, manipulator and hydraulic shear for cutting 14-inch square. The plant whose capacity is 1,000 tons 4-inch billets in 24 hours has given very satisfactory results. The same firm is installing a similar machine at the Washburn-Moen Works at Worcester, Mass.

The Parrish coke plant, consisting of 70 ovens, is being repaired by the Dunbar Furnace Co. and will be put into blast as soon as repairs are completed.

The Velti Foundry & Machine Co. has been incorporated at Pittsburg; capital, $60,000.

Chicago District and Northwest:—

The Chicago Boiler Cleaner Co., which has had offices in the Monadnock Block, Chicago, for several years past, has leased a store at 321 Dearborn st., and will carry a stock of goods there. The new quarters will, of course, be much larger, the increase of space being necessary for the greater business the company is doing. The move will be made May 1. The company sells besides the Chicago boiler cleaner, the Famous oil filter, and a line of flue scrapers, and is agent for the White & Middleton gas engine and for the Tweedale water purifier system for preventing the formation of scale in boilers. G. W. Atterbury is manager of the company.

The Republic Iron & Steel Co.'s East Chicago plant resumed work May 1, after an idleness of one month.

The Chicago Foundry Co. has been incorporated at Chicago by Thos. Koser and others; capital stock, $8,000.

Henry Hansen, of Chicago, received a verdict for $7,000 against the Illinois Steel Co. recently. In stating the case Hansen's attorney said the accident was due to the sudden cooling in water of a red hot steel rail, 40 feet long and weighing 3,600 pounds. This rail lay under other rails and when these were removed it sprung like a great bow, striking and crushing Hansen's leg.

The capital stock of the Illinois Malleable Iron Co., of Chicago, is increased from $250,000 to $500,000.

General Industrial Notes:—

The Illinois Steel Co. has ordered 22 gas producers, provided with Bildt automatic feed device, from Morgan Construction Co., of Worcester, Mass. These producers will be installed at South Chicago.

The Standard Automatic Gas Engine Co., of Oil City, Pa., is building three 600 h. p. gas engines for the Pan-American Exposition at Buffalo. The company is located in a new plant and has ever facility for taking care of its trade.

The Titusville Forge Co., Titusville, Pa., has recently finished the last of the new additions to its works and now has three times their capacity of a year ago.

The Warren Axe & Tool Co., of Warren Pa., which was burned out last February, has rebuilt and the new works will have double the capacity of the old. The company can turn

Vert. Receiver Form.

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out 50,000 axes per month, and is now fully ready for a large volume of trade.

Northern Engineering Works, crane builders, Detroit, Mich., have found it necessary on account of their increased electric crane business to remodel a portion of the building formerly used as a foundry, and turn it into an erecting shop, giving them 50x150 feet additional erecting space. They report an increasing demand for their product.

The Norwalk Foundry & Machine Co., operating a general foundry and machine shop at Norwalk, O., has received an order from an Eastern firm for a large amount of castings. It will keep the plant busy for some time to come.

The dismantling and tearing down of the machinery and buildings of the Columbia Iron & Steel Works, at Uniontown, Pa., began on April 16. This is the last chapter in the history of an industrial bubble which according to its promoter, was to make Uniontown a big industrial center. No one knows how much was lost through this disaster, but it runs into the millions.—[Bulletin.

The Sweet Steel Co., of Syracuse, N. Y., made the first heat in its new basic open-hearth furnace, April 16, and the furnace is now running satisfactorily.

The Pennsylvania Steel Co. will send a party of employes to Sanitago, Cuba, where the Juragua Iron Co. will build a large steel vaduct and several smaller bridges this summer. The bulk of the material has already been shipped.

The Creel interests of Mexico have purchased the plant of the Pass City Foundry & Machine Co., of El Paso, Tex., and will install additional machinery. A punch and shear and a set of rolls to use in connection with sheet metal will be put in at once.

The Roane Iron Co., at its quarterly directors' meeting at Chattanooga, Tenn., April 19, decided to erect another large furnace at Rockwood.

The works of the Tidewater Steel Co., Chester, Pa., are now running full blast for the first time since it came under control of the new company. Two furnaces in the open-hearth department of the big plate mill were started last week, making five furnaces in all.

The No. 1 furnace at the National Steel Co.'s plant at Youngstown, O., made a surprising record on April 22, when its output was 716 tons. For several days last week it ran up to 600 tons. Though it has been in operation but two months, a 700-ton output is likely to be a frequent performance in the near future.

The Forsyth Pattern Works, of Youngstown, O., have again increased their force of workmen and now employ more than at any time in their history. Increased demand for patterns in all lines is reported.

At Youngstown, O., about one-third of the Republic Iron & Steel Co.'s mills were in operation on half time last week. The company has increased considerably the force at work on its Bessemer steel plant at Youngstown, and it is expected it will be put in operation about June 1.

A fifth mill will be added to the tin plate plant at Cumberland, Md., operated by the N. & G. Taylor Co. of Philadelphia.

Work is being pushed as fast as possible on the new Shenango furnace of the National Steel Co., New Castle, Pa. The Cahall upright boilers have been practically installed and the stoves are being erected at a rapid rate.

The Dixon Mining Co., of Attalla, Ala., is developing iron ore mines and will be ready to ship within 60 days.

The following bids were received for the construction, delivery and erection of pumping machinery for California water works at Cincinnati, O.: R. D. Wood & Co., of Philadelphia, for the four pumping engines, $885,000 or $826,000, two plans being submitted with a bid for each plan; one electric traveling crane, $12,000; total of Wood's lower bid, $838,000. Holly Mfg. Co., Lockport, N. Y., for the engines, $1,195,000 or $1,057,000, alternate bids being offered as by the Wood

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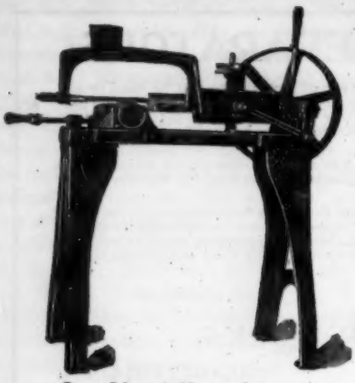

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Co.; for the traveling crane, $6,000; total Holly lower bid, $1,063,000. E. P. Allis & Co., Milwaukee, for the engines, $1,287,500; for the electric traveling crane, $12,500; total Allis bid, $1,300,000. Frisbie Engine & Machinery Co., Cincinnati, for the engines, $837,954; for the crane, $15,000; total Frisbie bid, $852,954. P. H. & F. M. Roots Co., Connersville, Ind., for the engines, $510,000. The last named company put in no bid on the crane.

The Olive Foundry & Machine Co., at Ironton, O., has just received a new upright planer weighing 12 tons. At present the company is busy with work for the Hecla Iron & Mining Co., the Union Iron & Steel Co., the Marting Iron & Steel Co., and other firms.

The Columbus, O., plant of the National Steel Co. has been closed for a time. Repairs will be made before resumption.

The Canton (O.) Rolling Mill Co.'s plant which has been closed for several weeks, resumed work April 30. This mill recently became the property of the American Sheet Steel Co.

As the result of a strike at the Aetna Furnace, Ironton, O., the furnace has been banked. The men demanded an increase of 25 cents per day.

Fred. H. Schmidt, secretary and treasurer of the Youngstown Bridge Co., says his company is in no way connected with the bridge consolidation. Some negotiations were made with the promoters but the matter was dropped.

The American Compressed Steel Car & Foundry Co., of New York, had a meeting recently to consider locating its new plant near Harrisburg, Pa. If this is done a site near Highspire, on which the company has an option, will notably be chosen.

The Stockham Manufacturing Co.

Within the past month the Stockham Mfg. Co., Grand ave., and N 46th ave., Chicago, has started up its malleable castings plant, which eventually will be one of the most complete of its kind in the country. The main building, housing the malleable molding room and the two air furnaces, is of brick, 100x300 feet, and is equipped with a traveling crane. A second building, of iron construction and iron roof, 180x140 feet in size, contains the annealing furnaces. The malleable plant has a capacity of from 30 to 40 tons of castings a day. The gray iron foundry, across the railroad tracks, from the malleable plant, employs 200 men in the manufacture of light castings, and is in a building with about 40,000 square feet of floor space, which is equipped with a jib crane, a Colliau cupola of eight tons capacity and a Whiting cupola of 15 tons capacity. This foundry has a capacity of over 18 tons of light castings a day. The plant also includes a brass foundry, a pattern shop employing 15 hands, a machine shop for finishing castings and for doing the company's repair work employing 15 men, and a polishing and plating room with a capacity of three tons of work a day. The entire plant employes electric distribution of power, and is very favorably located, being on the Belt Railway, the C. & N. W., and the C. M. & St. P. roads. The gray iron plant has been running for some years, but the malleable foundry has just been started up, and is not yet complete. Further work is to be done on it, and it is hardly expected it will be finally completed for several months. The company has been doing a very good business, both in malleables and gray iron, and has lately taken considerable export orders for the former, including some for shipment to South Africa. The officers of the company are William H. Stockham, president; S. T. Nicholson, vice-president, and W. S. Burling, secretary.

THE Dixon Crucible Co., in one of its recent publications to the trade refers to the fact that it makes large use in its own manufacturing operations, of every product it turns out, with the exception of crucibles and articles pertaining to foundries. It refers particularly to its silica graphite paint, which it

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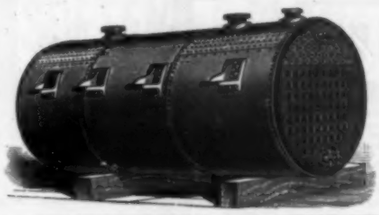

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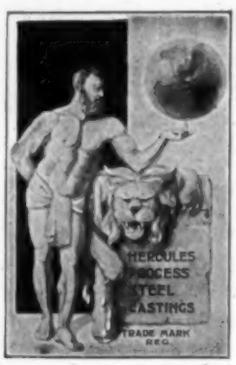

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Excursions to Chicago via Pennsylvania Lines.

For the Methodist Episcopal Church General Conference during the month of May low rate non-transferable round trip tickets will be sold to Chicago on May 1st, 2d, 7th, 14th and 21st; valid for return trip leaving Chicago not later than June 1st.

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The Seashore, Mountain and Lake Resorts constitute the most attractive pleasure grounds for the summer idler. They are within easy reach via Pennsylvania lines, and agents of that railway system will furnish full information about rates, train service and through car comforts to any of the summer havens. They will assist in arranging de-

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The annual low rate excursion to the seashore will be run via Pennsylvania Lines Thursday, August 9th. On that date reduced fare tickets will be sold to Atlantic City, Cape May, Anglesea, Avalon, Holly Beach, Ocean City, Sea Isle City, Wildwood, New Jersey, Rehoboth, Del., and Ocean City, Md. The round trip from Cleveland will be $13.50 to either of the ten resorts mentioned, which constitute the most popular summer havens along the Atlantic Coast. No more enjoyable vacation outing can be planned than a visit to the seashore in midsummer. Arrangements may be made for participating in the pleasures offered by this excursion by communicating with C. L. Kimball, Assistant General Passenger Agent, Cleveland, O.

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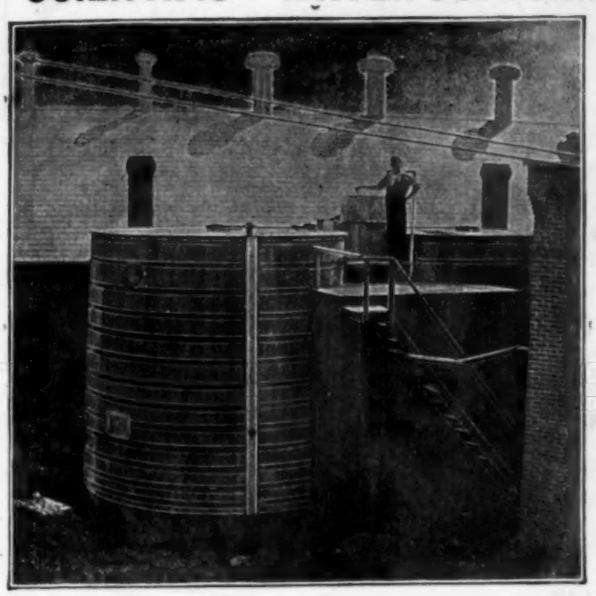

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Pittsburgh, Bellaire and East	† 3:10 pm	† 6:25 pm
Philadelphia and New York	* 2:10 pm	*11:30 am
Baltimore and Washington	* 2:10 pm	*11:30 am
Alliance and Pittsburgh	* 2:10 pm	*11:30 am
Ravenna and Alliance	* 3:10 pm	* 8:35 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
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Columbus and Cincinnati	* 8:35 am	* 5:40 pm
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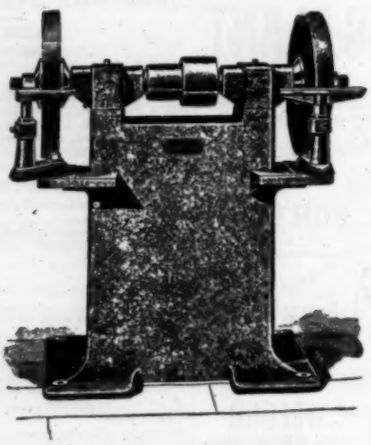

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P.M.	P.M.	A.M.	LV AR.	A.M.	A.M.	P.M.
4:25	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria.....	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6:05
5:15	1:57	8:00	Lester.....	8:15	10:41	5:47
5	3	1	Main Line	2	4	6
4:40	1:00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester.....	8:10	10:40	5:40
5:58	2:11	8:23	Medina.....	7:55	10:30	5:26
6:19	2:30	8:43	Seville.....	7:33	10:10	5:05
6:26	2:36	8:49	Sterling.....	7:27	10:04	4:59
6:48	2:58	9:11	Warwick.....	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon.....	6:40	9:18	4:11
7:31	3:40	9:58	Justus.....	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover.	5:55	8:34	3:26
8.08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.	.....	8:10	3:00
	6:50	1:15	Bridgeport...	.....	6:10	1:00
	7:05	.....	Bellaire.....	.....	5:55	.....
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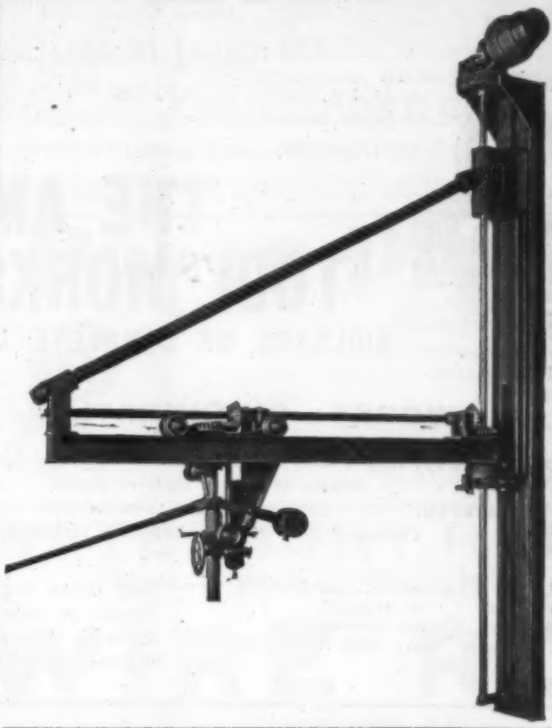

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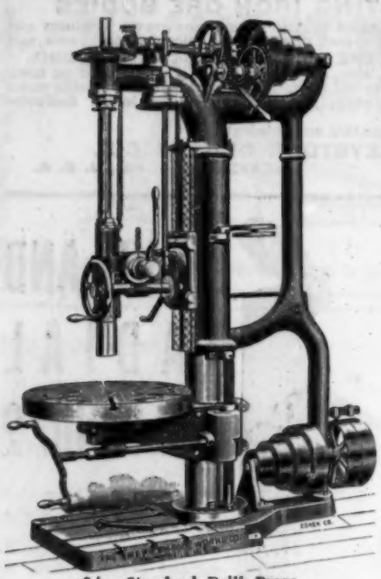

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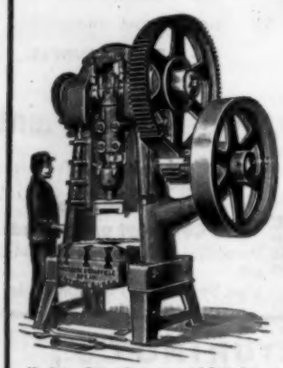

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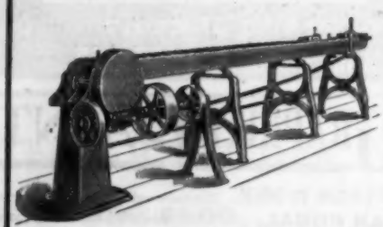

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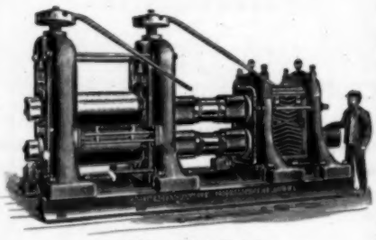

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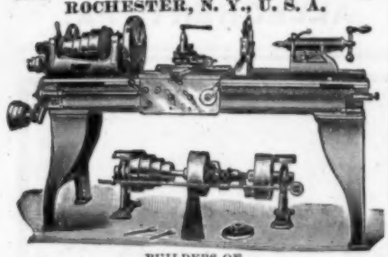

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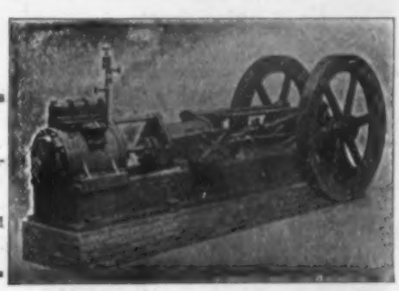

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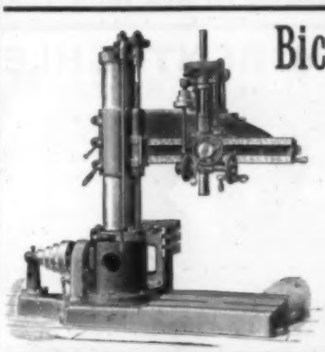

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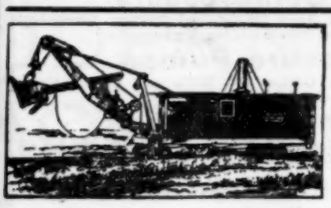

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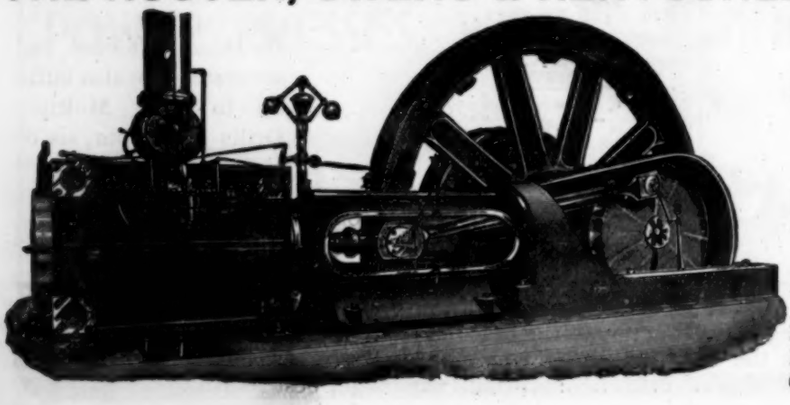

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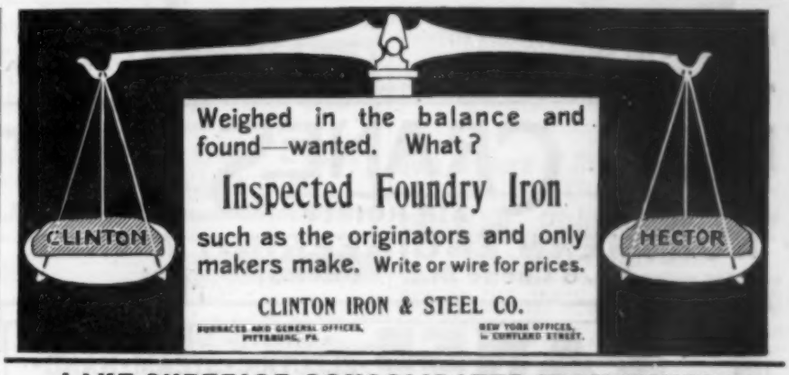
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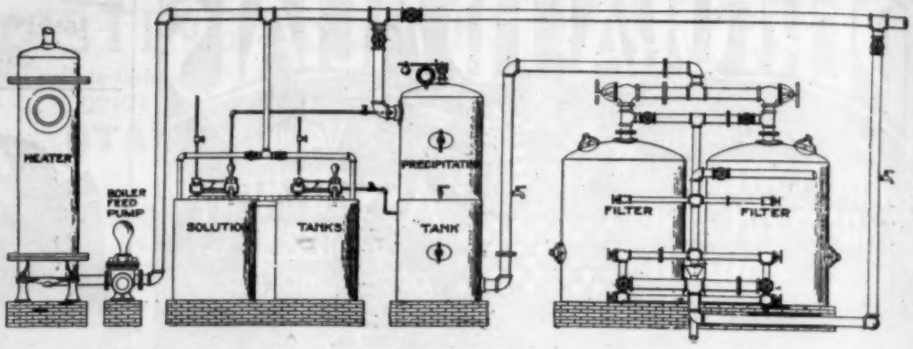

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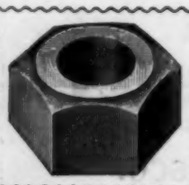

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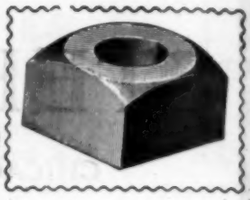

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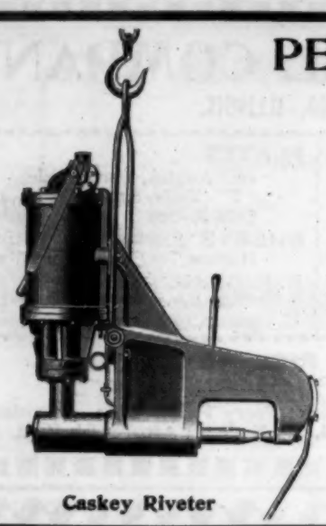

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Wanted—Machinists; will guarantee steady employment and highest wages to good men. Kilby Mfg. Co., Cleveland, Ohio.

Wanted—Good, first class machinists. Apply The Avery Stamping Co., corner Coe and Lake sts., Cleveland, O.

WANTED—Experienced foreman to take charge of our steel foundry; state experience. Also ten steel molders. American Hoist and Derrick Co., St. Paul, Minn.

WANTED — draughtsmen; experienced in detailing steel mill building and office building work; state experience, references, and salary expected. Shiffler Bridge Co., Pittsburg, Pa.

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Wanted—A firstclass engineer, who is thoroughly acquainted with compound Corliss engines A steady and permanent place. Alabama Steel & Wire Co., Birmingham, Ala.

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Capital to join in the manufacture of structural steel at an Eastern plant, consisting of basic open hearth works, blooming mill, large rolling mill, fully equipped with rolls, and bridge works. Money needed for improvements and working capital. Exceptional opportunity. Address X. Y. Z., care IRON TRADE REVIEW.

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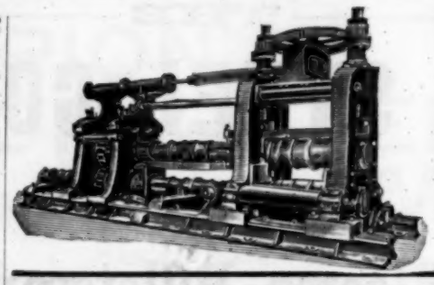

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Notice is hereby given that, owing to the retirement of J. H. Outhwaite, the partnership of J. H. Outhwaite & Company, composed of J. H. Outhwaite, W. G. Pollock and W. H. Becker, is hereby this day dissolved by mutual consent.

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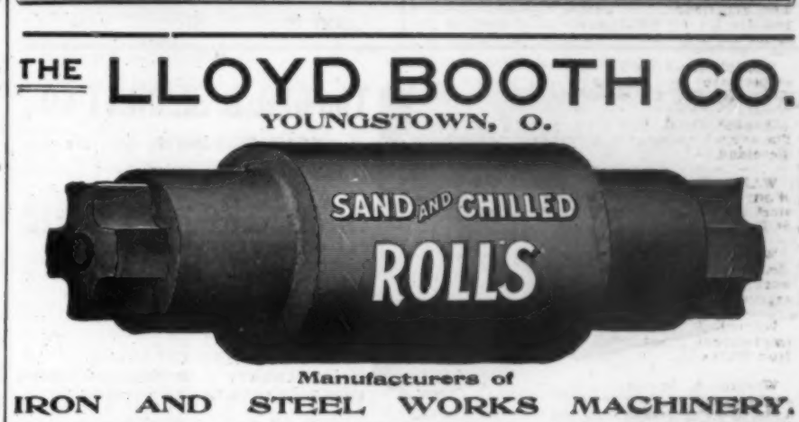

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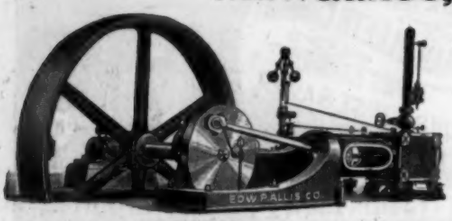

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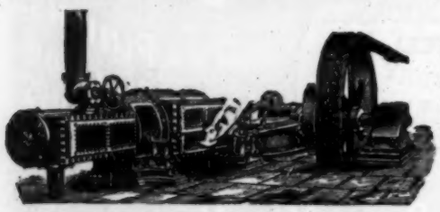

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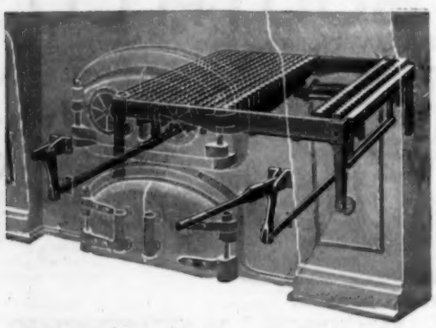

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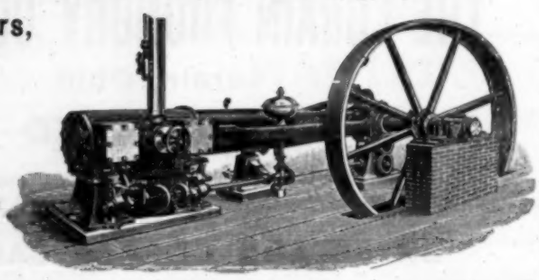

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Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. R. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
W. W. Lindsay & Co., Philadelphia, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.
Reinhold Bettermann, Johnstown, Pa.
Wright Mfg. Co., Cleveland, O.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES (STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
E. Keeler & Co., Williamsport, Pa.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
The Ideal Manufacturing Co., Buffalo, N. Y.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Brick Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
W. H. Haws Fire Brick Co., Mt. Union, Pa.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas Taylor's Sons Co. Cincinnati, O.
A. J. Hawes & Son, Johnstown, Pa.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLUE PLUGS—
Reinhold Bettermann, Johnstown, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Joseph Dyson & Sons, Cleveland, O.
Frankford Steel & Forging Co., Philadelphia, Pa.
J. & G. Obenberger, Milwaukee, Wis.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
Link Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Wheeling Mold & Foundry Co., Wheeling, W. Va
Macbeth & Co., Cleveland, O.

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co Harvey, Ill.
W. H. Haws Fire Brick Co., Mt. Union, Pa.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Brick Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Newport Sand Bank Co., Newport, Ky.
Maywood Foundry & Machine Co., Chicago, Ill.
A. J. Haws & Son, Johnstown, Pa.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hierts & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.
D. Clint Prescott Co., Chicago, Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GALVANIZED IRON—
American Sheet Steel Co., New York City.

GALVANIZERS—
American Sheet Steel Co., New York City.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAS PRODUCERS—
W. W. Lindsay & Co., Philadelphia, Pa.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Nazel & Bassett, Philadelphia, Pa.
Link Belt Machinery Co., Chicago, Ill.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
O & C Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland, O

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O
Link Belt Machinery Co. Chicago, Ill.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
The United Boiler Co., Girard, O.
The Ideal Manufacturing Co., Buffalo, N. Y.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
J. & G. Obenberger, Milwaukee, Wis.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
J. & G. Obenberger, Milwaukee, Wis.

HOLLOW SHAFTING—
Atlantic Tube Co., Pittsburg, Pa.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
Bertsch & Co., Cambridge City, Ind.
The Coulter & McKenzie Machine Co., Bridgeport, Conn.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Nazel & Bassett, Philadelphia, Pa.
The Coulter & McKenzie Machine Co., Bridgeport, Conn.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Link Belt Machinery Co., Chicago, Ill.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
The Ideal Manufacturing Co., Buffalo, N. Y.
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Champion Iron & Steel Co., Muskegon, Mich.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
National Steel Co., New York City.

METAL BEARINGS—
Theo. Hierts & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Swarts Metal Refining Co., Chicago, Ills.
J. J. Ryan & Co., Chicago, Ill.
D. Clint Prescott Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittson, Pa.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Wm. B. Pollock Co., Youngstown, O.
J. & G. Obenberger, Milwaukee, Wis.
Link Belt Machinery Co., Chicago, Ill.
Thew Automatic Shovel Co., Lorain, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill

NUTS (Self Locking)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.
Milton Manufacturing Co., Milton, Pa.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
American Tool Works Co., Cincinnati, O.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Car Co, Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Western Machinery & Supply Co., Chicago, Ill.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Western Machinery & Supply Co., Chicago, Ill.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,
J. H. Hillman & Son, Pittsburg, Pa.
C. R. Baird & Co., Philadelphia, Pa.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.
Massillon Iron & Steel Co., Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Wm. B. Pollock Co., Youngstown, O.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn
The Coulter & McKenzie Machine Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
W. W. Lindsay & Co., Philadelphia, Pa.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
The Coulter & McKenzie Machine Co., Bridgeport, Conn.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
American Tool Works Co., Cincinnati, O.

RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.

RAW HIDE GEARS—
Nasel & Bassett, Philadelphia, Pa.

RELAYING RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Youngstown Rivet Co., Youngstown, O.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

ROLLER BEARINGS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILLS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
West Penn Foundry & Machine Co., Avonmore, Pa.
Frank-Kneeland Machine Co., Pittsburg, Pa.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.
Link Belt Machinery Co., Chicago, Ill.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Western Machinery & Supply Co, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
Hyde Bros & Co., Pittsburg, Pa.
Russell Machine Co., Pittsburg, Pa.

SENSITIVE DRILLS—
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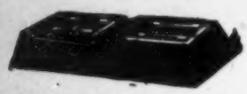

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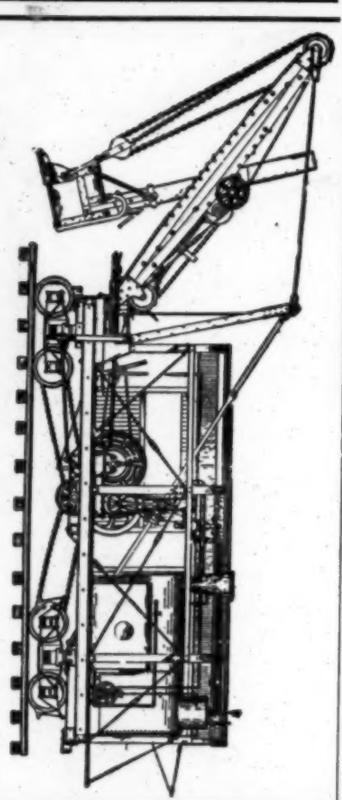

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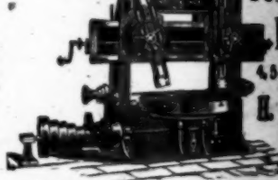

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